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APPL

HYDRAULICS

THE MAGAZINE OF FLUID POWER | Air Circuits · Electrical Controls

10th Anniversary Year

FEBRUARY 1957

Servo Controlled Aircraft Carrier Elevators/ 57

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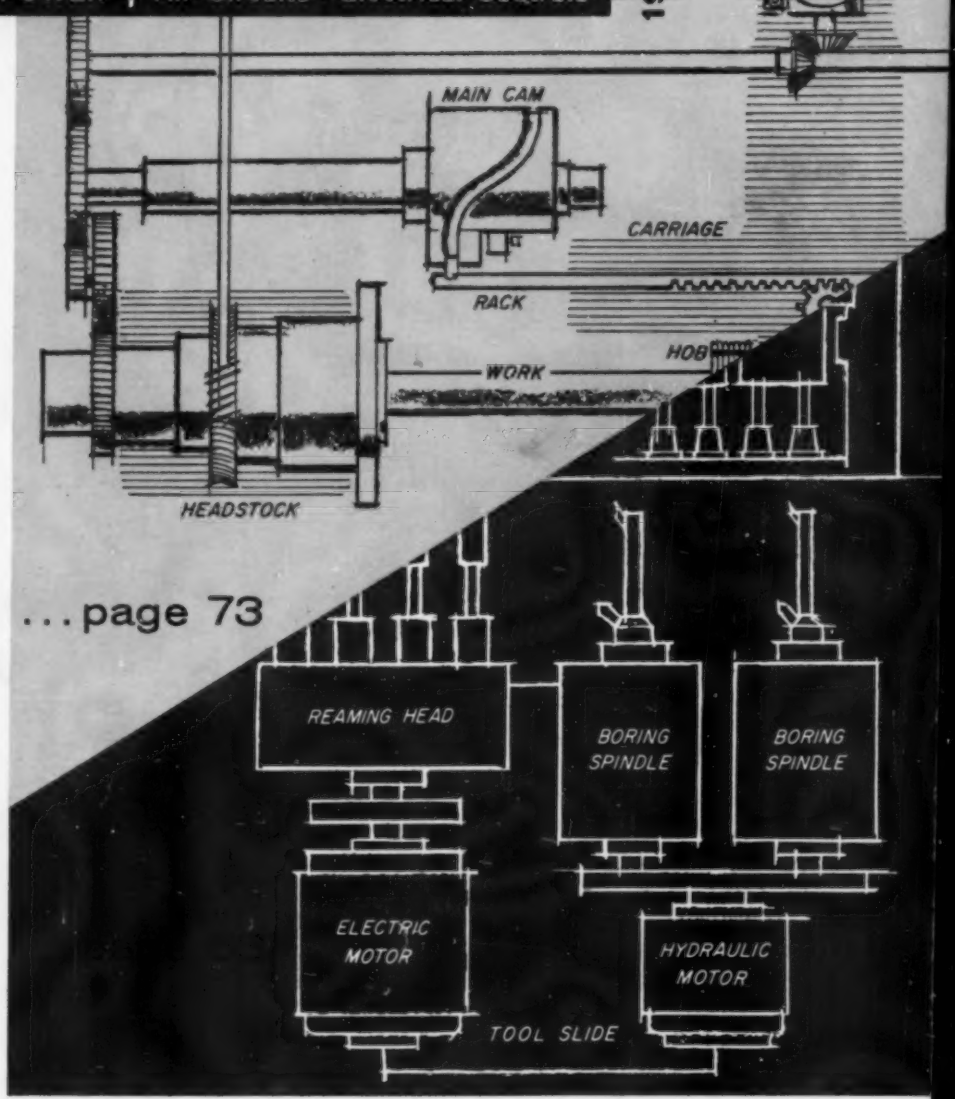
Push Button Control Part 2/ 77



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Fluid Motors . . . for machine spindle drives

For Information About
1957 PRIZE PAPER CONTEST
See page 116

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

GASOLINE
GREASE
HYDRAULIC FLUIDS
OXYGEN
WATER
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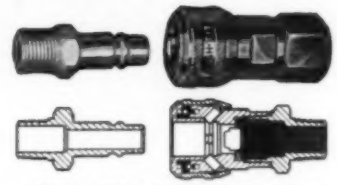
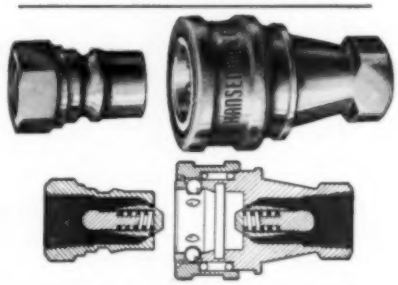
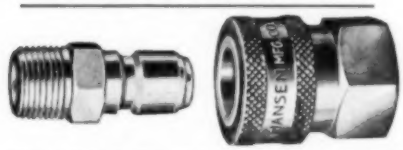


ONE-WAY SHUT-OFF



TWO-WAY SHUT-OFF



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Typical Cylinder Circuit Using Hanna Flo-Set Speed Control Valves

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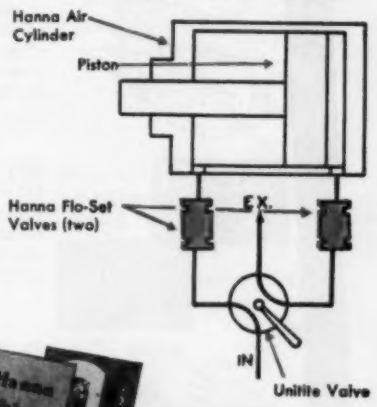

Consult your classified telephone directory or Thomas' Register for your nearest Hanna representative. Write for Hanna Valve Catalog 254 and Flo-Set Valve Bulletin 253A.

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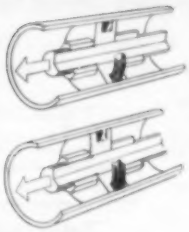

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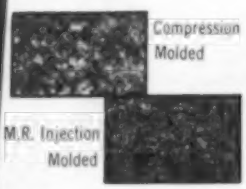
QUAD RINGS eliminate "spiral twist", a common cause of packing failure. At any pressure, less squeeze is required with QUAD RINGS than with O-rings. Truly effective sealing even for pressures as low as 0-5 psi. QUAD RINGS also give a positive seal under high vacuum. The 4-lip sealing surfaces reduce breakout and running friction—giving longer life. Seal perfectly even with a rougher groove finish.



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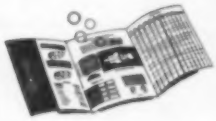
QUAD RINGS are injection molded by exclusive Minnesota Rubber process. Result is increased resistance to abrasions and chemical actions due to unequalled high density. Evidence of greater density is shown here in cross sections of Standard Buna N compound, .027" x .019", magnified 240 diameters by University of Minnesota.



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THE MAGAZINE OF FLUID POWER

FEBRUARY 1957 • VOLUME 10, NO. 2

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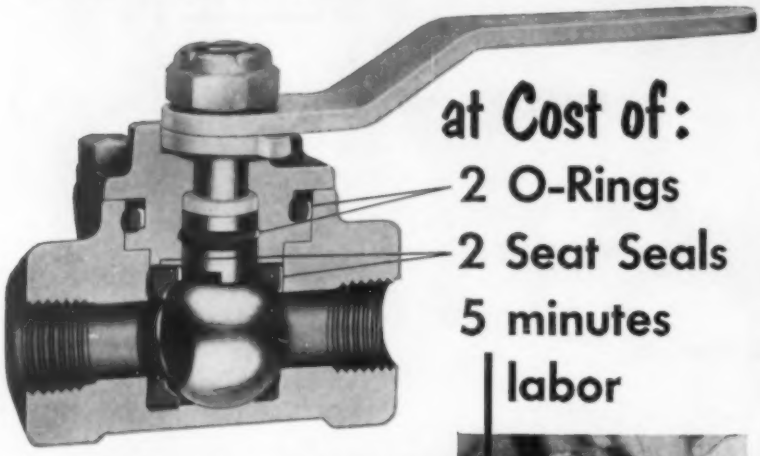
BPA

Install "NEW" Valve

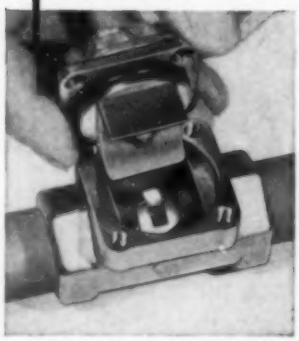


at Cost of:

2 O-Rings

2 Seat Seals

5 minutes labor



That's all it takes for easy TOP ENTRY "in-line" maintenance of Worcester's new TWIN SEAL BALL VALVE.* To replace sealing components, simply remove the four bonnet bolts, and then the bonnet assembly. Ball and seat rings are easily lifted out by using hook in the hole provided in the stem slot. After cleaning seating surfaces in the body, replace ball and new seat rings as a unit. A new O-ring at the bonnet joint and around the stem will assure tight seals at these critical points. Result? . . . "factory tight" sealing properties in your long lasting Worcester TWIN SEAL Ball Valve . . . plus flexibility of seat selection to suit a great variety of media.

*Patents Pending

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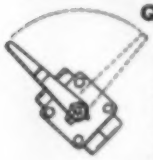
With opening in ball and seat rings maintaining same smooth shape as inside of pipe, resistance to flow is well below that of other valves and friction loss is reduced to a minimum.



QUICK OPERATION

The TWIN SEAL Valve goes from fully opened to fully closed position with only a quarter turn of handle and operator knows instantly position of ball and degree of closure. Valve adapts itself readily to remote control and mechanical operation.

FORGED CONSTRUCTION

Lack of porosity, closely held tolerances, absence of stress concentrations and the best possible material flow are some of the advantages of forged construction offered in Worcester's Twin Seal Ball Valve.

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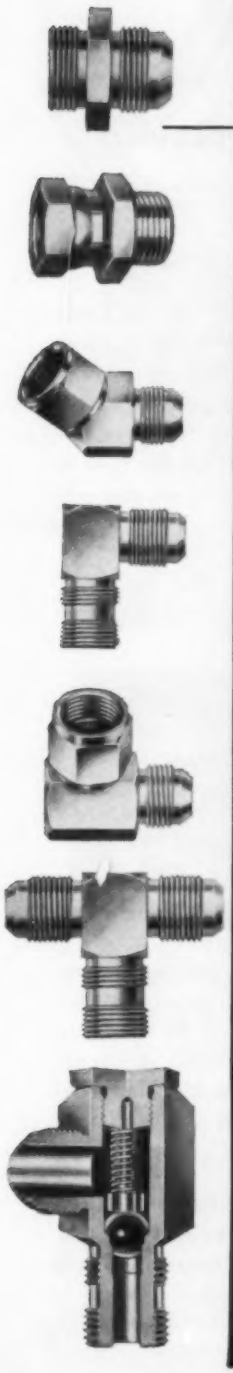

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Users and manufacturers of hydraulic equipment, will find the new Anchor Condensed Catalog No. 57-S a most valuable adjunct to their engineering or maintenance files.

It contains a condensed, yet very complete presentation of the Anchor Line of Hydraulic Hose Assemblies, Couplings and Fittings. The Anchor Line is so reviewed as to greatly simplify selection of the correct Hose Assembly, Coupling or Fitting for any given application.

Included in this catalog are descriptions of the most standard Anchor Products, including Anchor Ductile Sleeve Couplings and other permanently applied Couplings with 2-Wire Braid Hose for high pressures, and with 1-Wire Braid. Hi-Burst 2-Rayon Braid, or Spiral Wire Braid for medium and low pressures.

Also described are Anchor Reusable Couplings which include the commercial Duloc Couplings for QW and QWR Hose and Anchor Standard Reusable Couplings with 2-Wire Braid Hose for high pressures, with 1-Wire Braid Hose, Hi-Burst and Standard 2-Rayon Braid Hose for medium and low pressures.

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Also shown are the new Anchor SAE Adapters and Fittings designed to SAE Straight Thread "O"-Ring Boss standards, which are carried in stock.

This new condensed catalog of Anchor standard stock products is now available on written request. Write Anchor Coupling Co. Inc., 333 North Fourth Street, Libertyville, Illinois and ask for Catalog No. 57-S.

Fluid Power Lines

about Applied Hydraulics

SPINDLE DRIVES . . . Every engineer, executive, and salesman gets excited about *new* markets. What can we design for this new market? Can we compete? Who must I sell?

What provokes this note on new markets? Les Chaffee's article tells how his designers apply a fluid motor to drive the cutter on a thread miller. A second article by Wisconsin Motor's chief tool engineer, Harvey Prill, tells about fluid motor driven boring tools. Because use of fluid motors for spindle drives is not widespread, we believe this application can be considered as a good potential market for hydraulics.

Designers of machine tools will get ideas from the articles by Chaffee and Prill which may lead them to apply fluid motors to spindle drives. And perhaps men who design fluid motors and men who do application engineering will aim some of their efforts toward improving production machines with fluid motor drives.

SMALL CONTAMINANT, BIG TROUBLE . . . B. M. Dunham's article on oil in this issue emphasizes an often overlooked point in oil care. A user conscientiously changes oil at regular intervals, uses a suction filter and still gets poor life from his oil. How come? Dunham's article gives the answer. A small percentage of sludge left in the system between oil changes causes early breakdown of the new oil.

"LIVING IN A PUSHBUTTON AGE" . . . For the fluid power designer this has a specific meaning, because almost every machine requires pushbutton control. Contributing his experience to AH's series on electrical controls, Ken Rexford describes nine circuits employing pushbuttons, selector switches, and indicator lights in the article beginning on page 76. As chief electrical engineer at Hydraulic Press Manufacturing Co. Ken has worked out many electric control circuits. He is also experienced in fluid power design having spent five years engineering pumps, valves, and presses. A member of The American Institute of Electrical Engineers and a professional engineer, he has taken an active part in developing electrical control standards as a member and chairman of the National Machine Tool Builders' Association Electrical Committee.

Kenneth B. Rexford

HYDRAULICS AWEIGH! . . . Some of the first applications of oil hydraulics were on naval vessels of the early 1900's. It was logical to take advantage of fluid power for such high force requirements as steering. Today's Navy is mostly airborne, and one of the factors in designing an aircraft carrier is an elevator to raise airplanes to the flight deck This requires large, special equipment combined with large, special experience in designing installations of this type. In the article, *Servo Controlled Elevators*, C. M. Mullis and L. R. Rissler tell how elevators for the U.S.S. Forrestal were designed.

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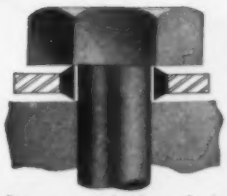
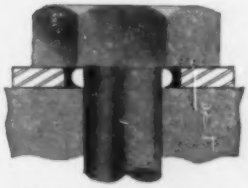


Dyna-seal before bolt head is drawn down



Bolt head drawn down -with pressure applied

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Typical Dyna-seal Applications

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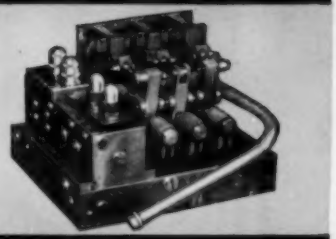

30 Dyna-seals solve plug-leakage problem on The NATCO Hydraulic Control Unit manifold.

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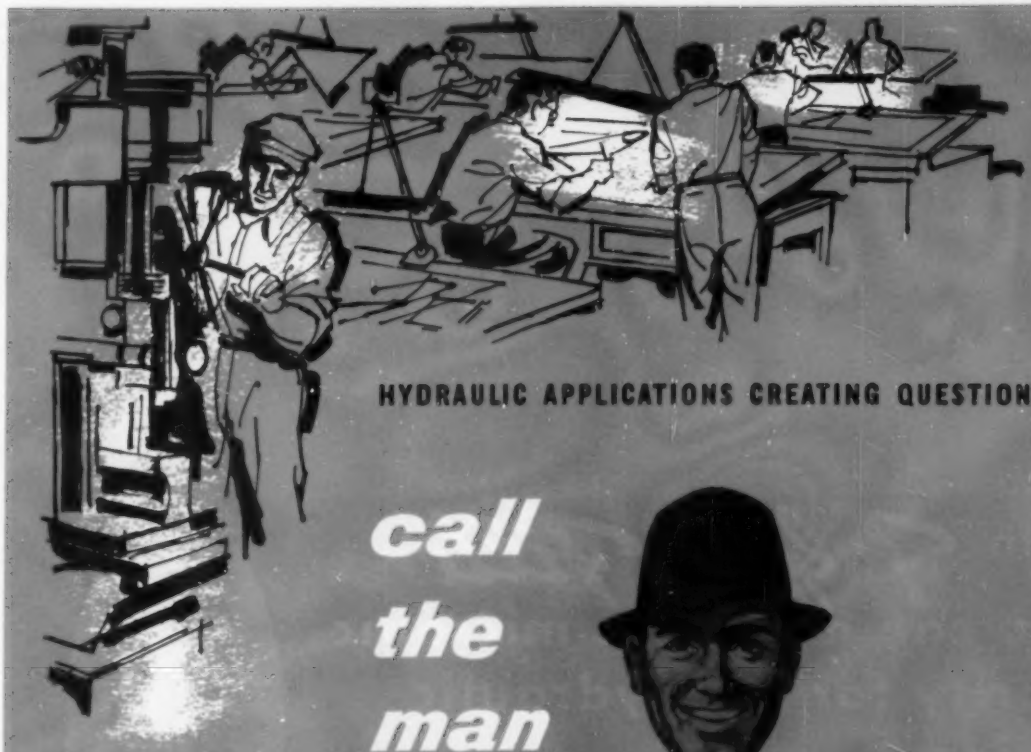

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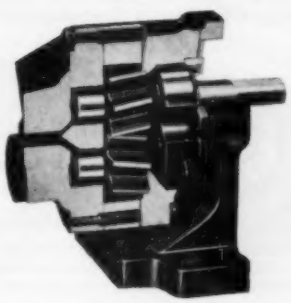

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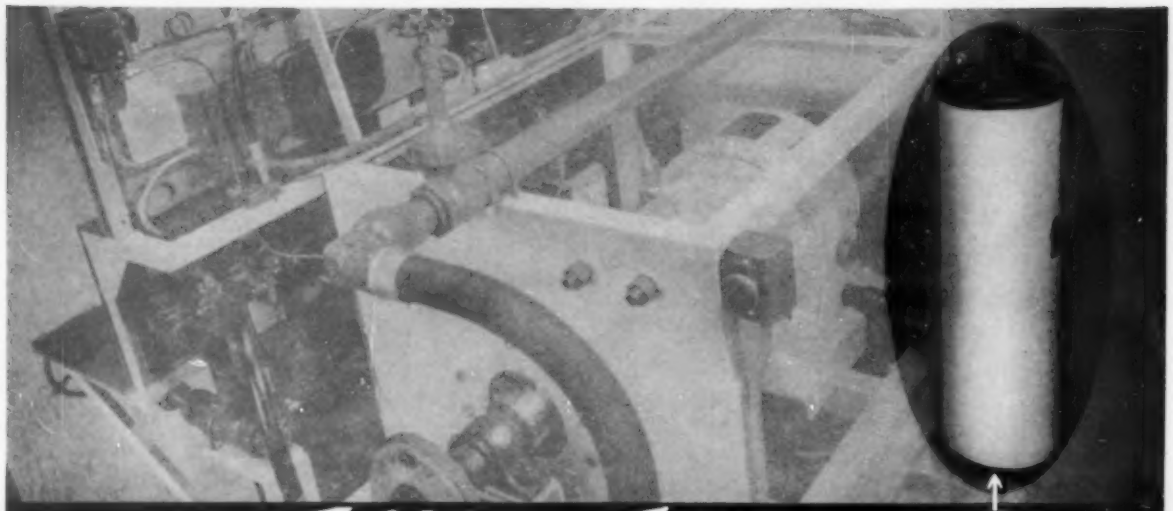

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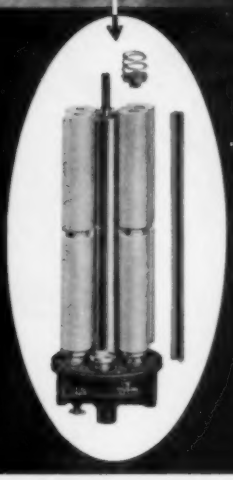


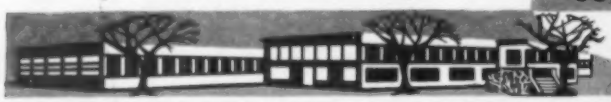
You can make substantial savings in prolonged fluid life, less down time and fewer repairs with Fulflo Filters.

Fulflo Filters are especially designed for micronic clarification of fluids used where exceptionally fine tolerances are involved. Fulflo Filters employ Honeycomb Filter Tubes, in a wide range of positively controlled densities, to give you the exact degree of micronic clarity needed for each operation. Fulflo Filters will *not* remove additives from oils. For replacement, be sure to insist on *genuine* Honeycomb Filter Tubes.

CFC (formerly Honan-Crane) Hydraulic Oil Purifiers prevent excessive wear of hydraulic parts and prevent clogging of valves and pistons. Filter medium is Cranite (Fuller's earth) for removal of soluble impurities as well as abrasive solids. CFC Purifiers are designed for direct connection to an individual system, as mobile units, or as part of central oil system. They quickly pay for themselves through reduced consumption of oils.

Commercial Filters Engineers are ready to help you with any problems involving fine filtration of hydraulic fluids. Write for technical literature to Department AH.

Micro-Fine Filtration for Low Cost Clarity



COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
FURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
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VIX-SYN PACKINGS

meet demands of newest valve design with precise sealing ability ... complete dependability

You see them everywhere—small valves that work under high pressures, all-important control links in new hydraulic and pneumatic systems. They're vital in industry's new trend to automation.

There's one design problem common to almost all these valves . . . getting a seal that's tight, dependable and long wearing, yet allows free valve movement for precise and rapid operation and control.

It's a tough problem, but there's a quick and easy answer in Houghton Vix-Syn "O" rings and packings. You can put them into the most demanding valve designs with complete assurance of dependability, high efficiency in sealing, economy, and long, trouble-free service life.

Houghton developed synthetic rubber specifically to provide design engineers with "O" rings and packings that match the requirements of the newest, most modern valve designs. Call on Houghton, too, for specially molded Vix-Syn parts and compounds. You'll be served by the same packing specialists who set the packing standards industry everywhere uses today.

Ask your Houghton Man for the full story of how Vix-Syn takes the problems out of valve design. Call him today—or write E. F. Houghton and Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

VIX-SYN

. . . a product of

E. F. HOUGHTON & CO.

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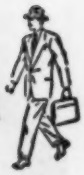

Ready to give you on-the-job service . . .

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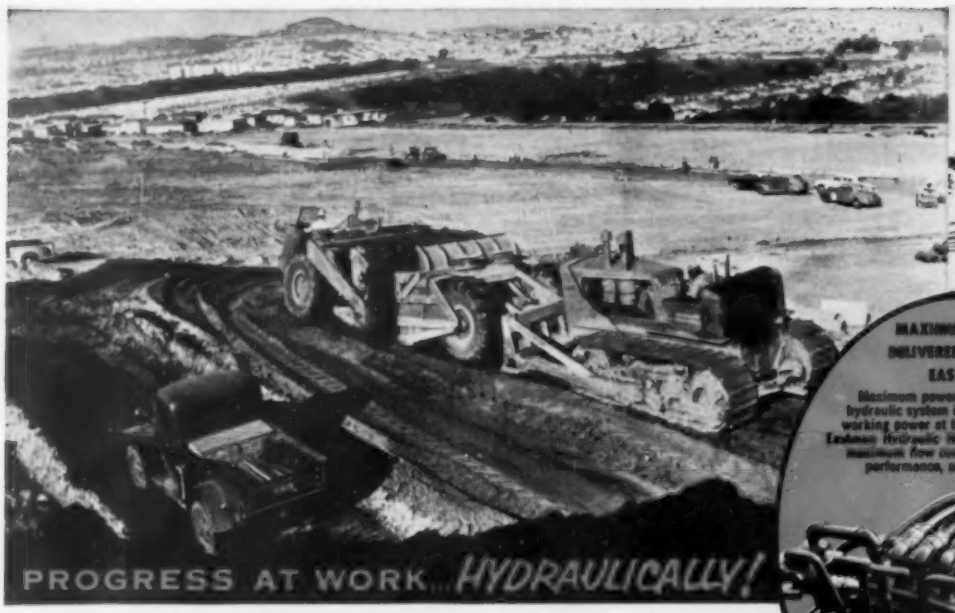

America's Future Lifeline of Travel

MAXIMUM POWER DELIVERED THROUGH EASTMAN
Maximum power delivery for every hydraulic system is the key to efficient working power at the point of operation. Eastman Hydraulic Hose Assemblies provide maximum flow consistent with efficient performance, service and safety.

SMOOTHER AND SAFER ROADS ARE BEING BUILT FASTER... THROUGHOUT AMERICA *with*

HYDRAULIC POWER delivered thru

EASTMAN HYDRAULIC HOSE ASSEMBLIES

Modern Hydraulics will put millions of horsepower to work building America's roads . . . maneuvering mighty earth-moving machines with finger-tip ease. Grading, loading, leveling and finishing will be easier, more economical—saving time, money and manpower.

Many Pioneer Manufacturers of modern road building equipment have, from the beginning of hydraulics—equipped their machines with Hydraulic Hose Assemblies made by the very first pioneer manufacturer in this field—EASTMAN of Manitowoc, Wisconsin.

Eastman's Continued Leadership has been maintained through advanced engineering and design—plus materials and workmanship which are so high that they are accepted by many Original Equipment Manufacturers as the *standard for the industry!*

Eastman Is Geared to supply the critical demand for performance-tested Hydraulic Hose Assemblies which will more than meet the roughest road building construction hazards. Many 'round the clock operations will now run into year-'round schedules, and Eastman's new production facilities stand ready to provide *dependable shipments, service and satisfaction.*

FOR INCREASED EFFICIENCY IN HYDRAULIC POWER
Specify EASTMAN
HYDRAULIC HOSE ASSEMBLIES

EASTMAN'S NEW "HI-FLO" COUPLING DELIVERS A MAXIMUM OF POWER

EXCLUSIVE GRIP ADVANTAGES WITH INTER-LOCK ® CLAMP COUPLING

CUT COSTLY "DOWN-TIME" WITH EASTMAN RE-USABLE COUPLINGS

ADAPTERS AND ADAPTER UNIONS, STRAIGHT, ANGLED, TEES FOR HOSE ASSEMBLIES AND RE-USABLE COUPLINGS

BULKHEAD "O" RING ADAPTERS, HYDRAULIC TUBE FITTTINGS, UNIONS, ELBOWS, "O" RING ADAPTERS AND LOCKNUTS FOR ALL HOSE ASSEMBLIES, RE-USABLE COUPLINGS

Eastman
first in the field

MANUFACTURING COMPANY
Dept. AH-2, Manitowoc, Wis.

WRITE **for bulletin to suit your needs or send specifications**

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS Magazine, 812 Huron Rd., Cleveland 15, Ohio.

Valves In Series

We operate 5 small presses for shearing, notching, punching and bending light angle steel. The 5 cylinders, one on each machine will operate off one power unit by branch piping off the main hydraulic circuit. Each machine has a 4-way, 3-position, lever-operated valve. Can we hook the 5 valves up in series?

WILLIAM F. SHEA
East Detroit, Mich.

Hooking up these valves in series is practical when only one ram at a time needs to be operated. We sent you a sketch indicating how the tank port of one valve is connected to the pressure port of the next valve.

Pressure Switches

We are planning an extensive training program for our local and regional engineering representatives. We would like to have the data published in APPLIED HYDRAULICS on Pressure Switches in April, June, August and September, 1956.

GENE H. WHITE
Sales Manager
Leach Corporation
Los Angeles, Calif.

Tearsheets of articles on pressure switches have been sent. We also sent you a copy of the January, 1956 issue of APPLIED HYDRAULICS *which provides a bibliography for this field.*

Conference Paper

In the October 1956 issue of APPLIED HYDRAULICS, reference was made to a paper "High Temperature Hydraulics", by D. B. Gardiner and F. L. Moncher of

Continued on page 16

6000 PSI
wide range, high-flow regulator

maintains high degree of accuracy with regulated pressures from 0 to 5000 psi!

performance features:

- Normal inlet pressure of 6000 psi!
- Wide adjustment range of 0 to 5000 psi with extreme sensitivity!
- Burst — 15,000 psi!
- Maximum required handle torque 30 inch lbs. due to planetary gear system in handle!
- Adaptable for use with air, nitrogen, helium and gaseous oxygen!
- ¼" tube straight thread gasket seal bosses per AND10050!
- Also available in AND10053 ¼" pipe thread!
- Internal valve and filter are removable without disturbing spring, diaphragm structure!
- Internal relief valve adjustable over entire outlet pressure range!
- Internal 5 micron filter!
- Bubble-tight shut-off!
- Adjustable mounting!

Please send me engineering data information on:

Part 110700—Air, nitrogen, helium. _____

Part 111700—Gaseous oxygen only. _____

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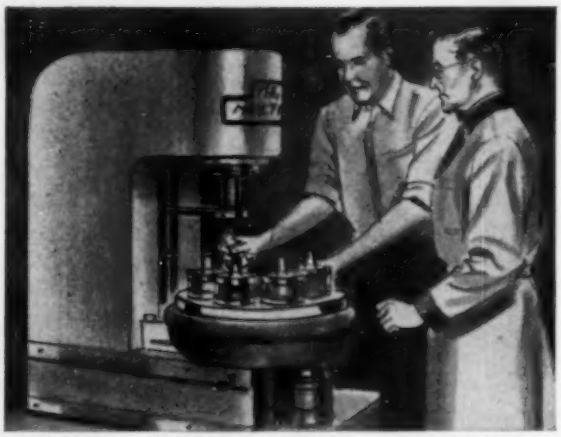
ACCESSORY PRODUCTS CORP.
Dept. A-2, 616 W. Whittier Blvd.
Whittier, Calif. Phone: OXford 3-3747

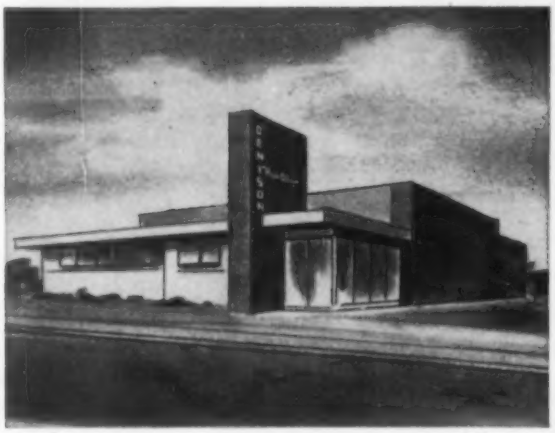
Complete hydraulic service... from one dependable source...

DENISON

FREE APPLICATION ENGINEERING by experienced hydraulics specialists to improve your circuits.



JOB DEMONSTRATIONS to *prove* how your operations can be made more efficient with the new hydraulic developments.



REGIONAL FACTORY SERVICE includes *complete maintenance facilities* for building, testing, repairing equipment.

OVER-THE-COUNTER SALES from local stock to give you *immediate delivery* of hydraulic pumps, motors and controls.

Behind the name Denison... With its regional warehouses and branch offices, Denison's factory service is now as near as your telephone. Specialists in hydraulics are immediately available to help you build a better product, build it for lower cost.

Regional Warehouses in Chicago, Houston, Los Angeles, Clark, New Jersey. Branches in every principal city.

DENISON ENGINEERING DIVISION

American Brake Shoe Co.

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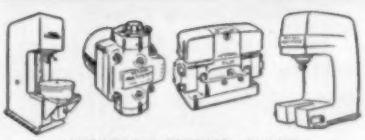
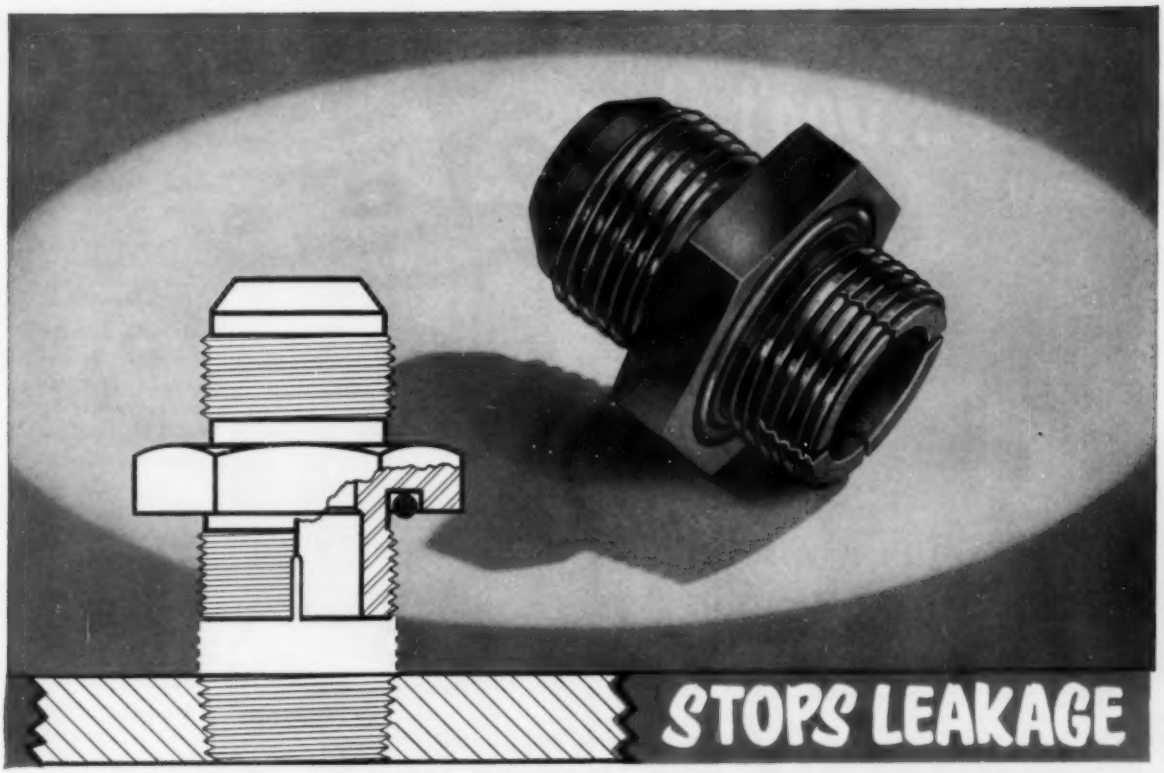
DENISON HydrOILics



HYDRAULIC PRESSES • PUMPS MOTORS • CONTROLS



PETCH-HUPP *RING-WEDGE* ADAPTER

NOW AVAILABLE TO STOP PIPE THREAD LEAKAGE WITHOUT SPECIFYING STRAIGHT THREADS

- Use with standard tapered female pipe threads
- No special tools required
- Tube end utilizes standard 37° Flare fitting elements
- RING-WEDGE male thread slotted allowing O-ring seal contact independent of port thread depth
- O-ring does not interfere with threads
- O-ring seals on port boss-spot face optional — no pipe sealing compound required

Part No.	Tube O.D.	Used w/ NPTF
821RW 6	⅜"	¼"
821RW 6-6	⅜"	⅜"
821RW 8-4	½"	¼"
821RW 8	½"	⅜"
821RW 8-8	½"	½"
821RW 8-12	½"	¾"
821RW 10	⅝"	½"
821RW 12	¾"	¾"
821RW 14	⅞"	¾"
821RW 16	1"	1"
821RW 20	1¼"	1¼"
821RW 24	1½"	1½"
821RW 32	2"	2"

PETCH PMC

SALES—463 York, Detroit 2
PLANT—Alpena, Michigan

MANUFACTURING COMPANY

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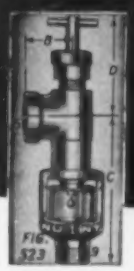
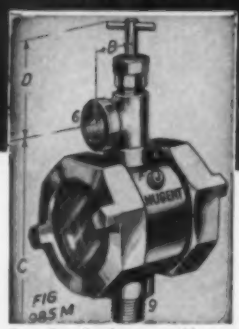
See...Don't Guess

Install NUGENT Sight Feed Valves for LUBRICATION CONTROL



13 models designed for working pressures to 125 psi. Sizes to ¼ inch.

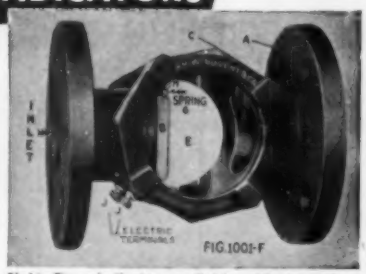


9 models for large machinery. "Swivel and lock" type for sight chamber adjustment to most convenient view position.

Medium size needle type with steel valve stem. 9 models. Sizes to ¾ inch.

WITH a Nugent Sight Feed Valve in your oil line, you can tell at a glance whether or not vital parts are receiving proper lubrication. Nothing is left to chance and there's no guess work involved. Oil flow through the valve is controllable from 2 drops per min. to 21 gals. per hour depending upon oil viscosity and valve model. All are vented to prevent air binding. Glasses and screens are removable for cleaning without interrupting oil flow.

SIGHT FLOW INDICATORS



Sight Flow Indicator available with tapped or flanged connections. Removable windows. Can be installed right or left hand or vertically.

ANOTHER NUGENT instrument for solving lubrication problems is the Sight Feed Indicator. Installed in a machinery oil system, this device sounds an alarm when oil is not getting to bearings. When oil is not flowing properly, Indicator "B" (See Fig. 1001-F) closes making contact with terminals "J". This sounds the alarm making it possible to locate trouble quickly, protect valuable machinery and save on costly down time.

For trouble free lubrication systems, write for descriptive bulletin on the Nugent Sight Feed, Sight Flow Indicator and other Lubrication Specialties.

Wm. W. Nugent & Co., Inc.
3432 Cleveland St. Skokie, Illinois

Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • La Jolla, Calif. • Los Angeles Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

LETTERS to the editor

Vickers Incorporated. We would like to obtain a copy.

(MRS.) SARA T. MOXLEY
Manufacturing Engineering
Grumman Aircraft Engineering Corp.
Long Island, N. Y.

This paper was presented at the National Conference on Industrial Hydraulics. Complete Proceedings of the Conference should be available soon. Hardbound copies will sell for approximately five dollars. Address your order to Raymond D. Meade, Conference Secretary, National Conference on Industrial Hydraulics, Technology Center, 3300 S. Federal St., Chicago 16, Illinois.

5000 PSI Pneumatics

Please send me a reprint of the article by A. E. Schmidlin, titled "5000 Psi Pneumatic System", which appeared in the October 1954 issue of APPLIED HYDRAULICS.

JOHN E. GIBSON
Assistant Professor of
Electrical Engineering
Yale University
New Haven, Conn.

Reprint has been sent.

Films

We would like to know where we can get motion pictures or slides on hydraulic components and their applications.

D. C. STONEMAN
Advanced Mfg. Development Sec.
General Electric Co.
Fort Wayne, Ind.

We have sent a copy of the January 1956 issue of APPLIED HYDRAULICS. *The Fluid Power Engineering Index includes a film list, giving information on availability of films in this field.*

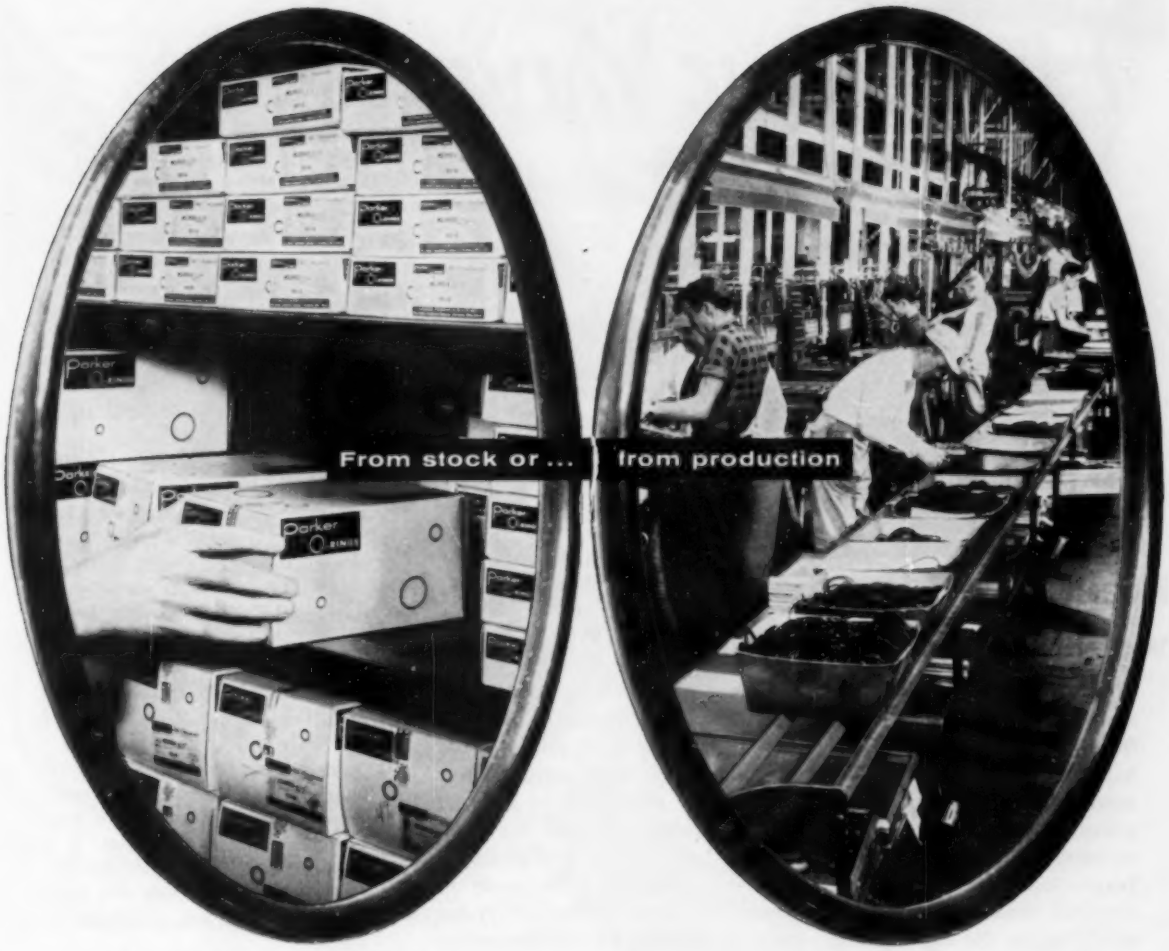
Servo Valves

I have read and re-read W. Holzbock's article in the November issue comparing three servo valve designs.

It may interest your readers that in this country we have slightly different experience which

Continued on page 18

No matter how many you need...



we offer fast delivery of O-rings!

Parker can meet *any* demand for O-rings. Factory stocks (millions of O-rings) are maintained in Chicago, Cleveland and Los Angeles. Large warehouse stocks are available at more than 50 Parker O-ring distributors. You can get standard sizes of AN, MS, industrial specifications, etc., right off the shelf. (And we have over 296 standard O-ring sizes with many different standard compounds.) Parker also has the production facilities to handle "specials" and volume requirements.

From Parker you get exactly the right O-ring for your specific requirements. Our engineering service will help you with any designing problems. We invite you to prove by comparison tests how Parker O-rings seal better and last longer.

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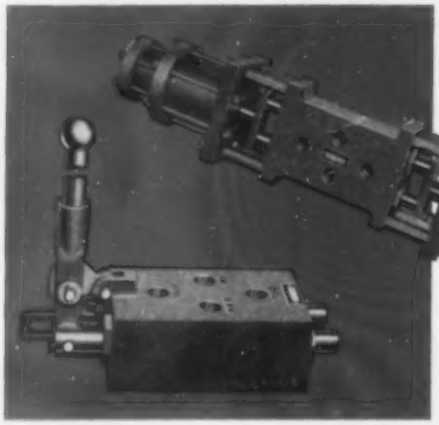
Quick-As-Wink® Hydraulic Valves



Double Pilot Cylinder Operated 3-position 4-way Hydraulic Valve

(At left) Lever Operated 3-position 4-way Hydraulic Valve

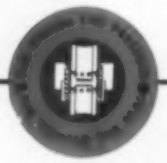
Hand and Pilot-operated Types for water or hydraulic oils to 5000 psi.

• These valves give users maximum efficiency, economy and dependability. Housings are milled from steel blocks or bronze forgings. The hollow, radially ported, stainless steel plungers are hard chrome plated and polished. Renewable metal valving rings assure long life of the packers which are expanded by internal pressure . . . the higher the pressure the tighter the seal. No metal to metal seating. The valves are fully balanced in any position. Inspection — and servicing if necessary — can be done easily *in the field,* avoiding the delays of returning valves to the factory for servicing, or the need to carry large inventories of standby valves — or even parts. Complete dimensions, capacities and other data sent promptly. Write for Bulletin No. 531,— Today!

Ask us also about . . .

CAM OPERATED SINGLE PLUNGER VALVE ⅜" to ¾" sizes. Operated by rotating cam or lund on reciprocating device.

DOUBLE SOLENOID "O-TYPE" VALVE for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.



Quick-As-Wink® AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1991 East Pershing St., Salem, Ohio

LETTERS to the editor

prompts us to draw different conclusions in the manufacture of servo valves.

We have made many servo valves but we have never made one with an under-lap of .005" per land. Moreover such a definition is meaningless because no limits are stated within which the .005" under-lap has to conform on all 4 lands of a 4-way spool valve. Holzbock asserts that such a valve is difficult to make. We have not found it so, and we can regularly work to a limit of lap, on 4 lands, to within .0001, and I do not mean ± either.

We realize that in your country the hole and plug valve, which we call the swinging gate valve, has been experimented with to some extent. We have found that this type of valve presents problems in filtration, while both the baffle and nozzle valve, which we call the swinging reed valve, as well as the jet pipe valve, is at least as difficult to make as any spool type valve.

In striving for linearity we still believe that 3 and 4-way spool type valves are at present the most promising for development. It is possible to compensate for the Bernoulli forces, so that very small power is required to move the spool.

C. S. SAWYER-KAMMER
Reilly Engineering Ltd.
Guildford, Surrey
England

Unloading Valve

We are looking for an automatic valve to maintain an accumulator charge between fixed limits and unload the pump for other uses when not charging the accumulator. Operation must be completely hydraulic.

W. C. HUTTON
Fluid Power Corp.
Oklahoma City, Okla.

There are several sources for a completely hydraulically operated unloading valve for your accumulator circuit. Whether they are applicable to your job would

Continued on page 20

ALEMITE Announces

the all-new SURGEPRUF LINES OF REUSABLE COUPLINGS AND RUBBER HOSE

...Available Now Nationwide!

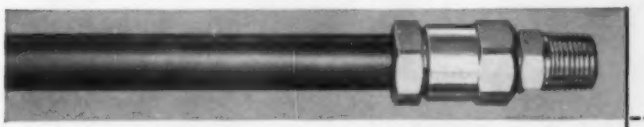
Now, for the first time, Alemite brings you a completely new line of *reusable, non-skive* couplings and hydraulic rubber hose—exclusively designed for faster, more economical replacements . . . to cut maintenance costs, downtime and inventories!

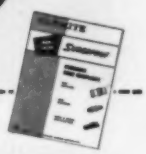
Rugged Alemite Surgepruf Couplings meet practically any original equipment or field replacement need. Hose are available for either medium-high or high-pressure service, with single or double wire braid. Couplings are made of high-strength steel . . . and J.I.C. thread design assures positive, long-lasting seal.

Contact your nearest Alemite Distributor for full details. Standardize—*save money*—on the complete new line of superior Alemite Surgepruf equipment!

Only Alemite Surgepruf Couplings Offer All These Advantages for Faster On-the-spot Replacements and Repairs!

- NO HOSE-SKIVING REQUIRED! "Double-wedge" grip forces coupling threads through rubber cover . . . grips either single or double wire braid solidly. Saves both time and labor!
- GIVES TIGHTER GRIP! Double-wedging action gives tighter grip as insert is drawn farther into coupling.
- NO SPECIAL ASSEMBLY TOOLS REQUIRED! Fast, easy assembly with just ordinary tools!
- TYPES AND SIZES FOR ALL HYDRAULIC LINES.





New Alemite Surgepruf Couplings and Hose Have Been Factory-tested and Field-proved!

ALEMITE
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1850 Diversey Parkway, Chicago 14, Illinois

Please send me my free copy of the complete Surgepruf Catalog.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

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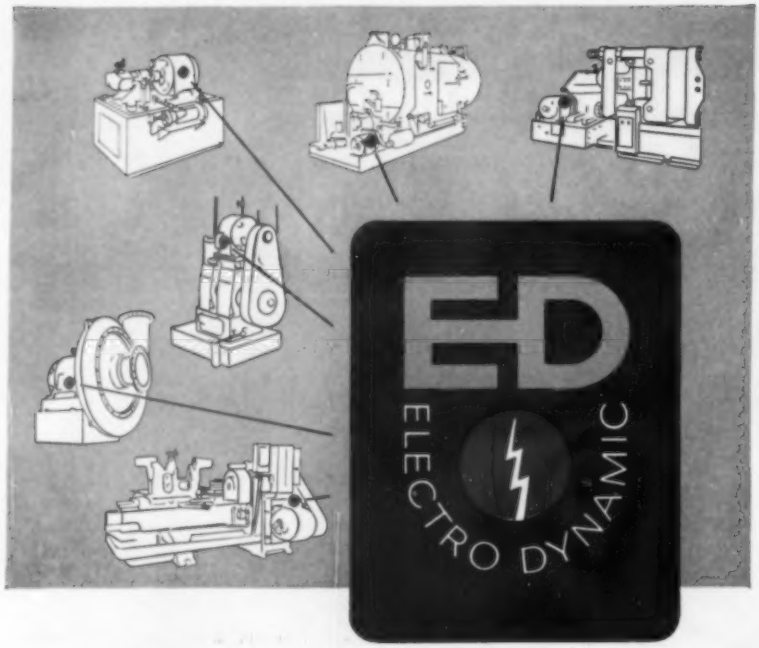
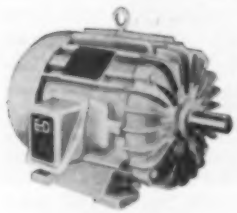
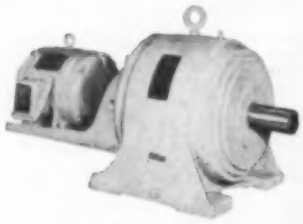




STANDARD MOTORS

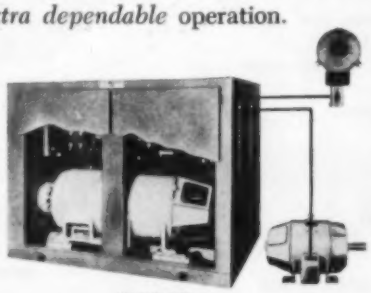
THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY



GEAR-ED-MOTORS

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.

SELECTRON
VARIABLE-SPEED DRIVES



SELECTROL
VARIABLE-SPEED DRIVES

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS
CORPORATION
BAYONNE, NEW JERSEY

LETTERS to the editor

depend upon the flows you encounter. The application is fairly common. We have sent you the names of some manufacturers.

Hydrostatic Transmissions

Please send us 4 copies of APPLIED HYDRAULICS for December, 1956. We would like these because of the articles on transmissions.

ARVID A. JOHNSON
Assistant Chief Engineer
Drott Manufacturing Corp.
Wausau, Wis.

Copies requested have been sent.

Small Valves

We are in the market for some small 4-way solenoid operated hydraulic valves. They are used to operate a 1-inch bore by 4-inch stroke, double-acting hydraulic cylinder, at 1000 to 1500 psi, ¼-inch pipe connections.

FRANK H. FIELD
President
Field Engineering Products Co.
Jamestown, N. Y.

There are several sources for these ¼-inch, solenoid operated, 4-way hydraulic valves. We have given you the names of several manufacturers. Because of the solenoid, it would be difficult to reduce the physical size of these valves.

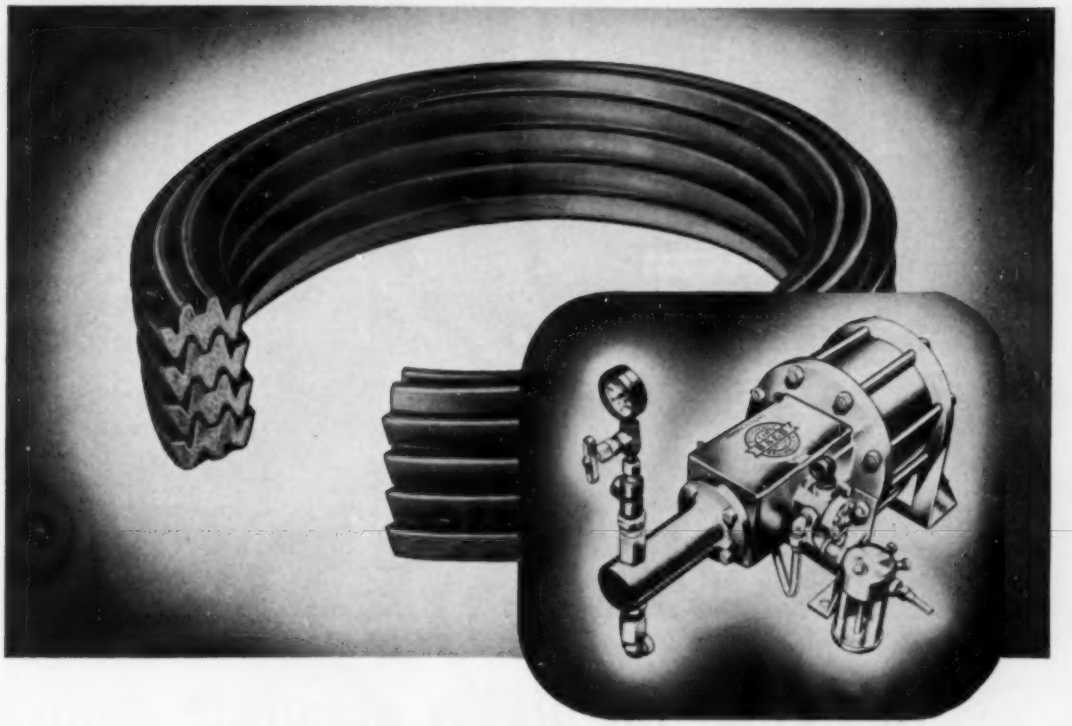
NCIH Preceedings

Where can we obtain the minutes of the 12th Annual Conference on Industrial Hydraulics, held in Chicago October 18th and 19th?

W. D. CROSS
Assistant Chief Engineer
Redco Tool Division
Red Lion Cabinet Company
Red Lion, Pa.

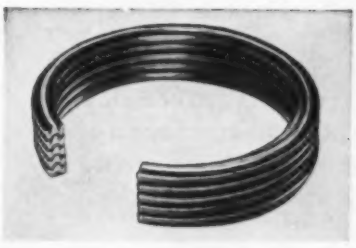
Complete "Proceedings" will be published in book form by the Conference early in 1957. To order copies write to the Conference Secretary, Raymond D. Meade, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, Chicago, Illinois. ▼▼▼

J-M Uneepac® does it again!



"Very satisfactory sealing service against wide variety of fluids and pressures up to 5,500 psi"

says Black, Sivalls and Bryson, Inc. makers of BS&B Glycol Pump



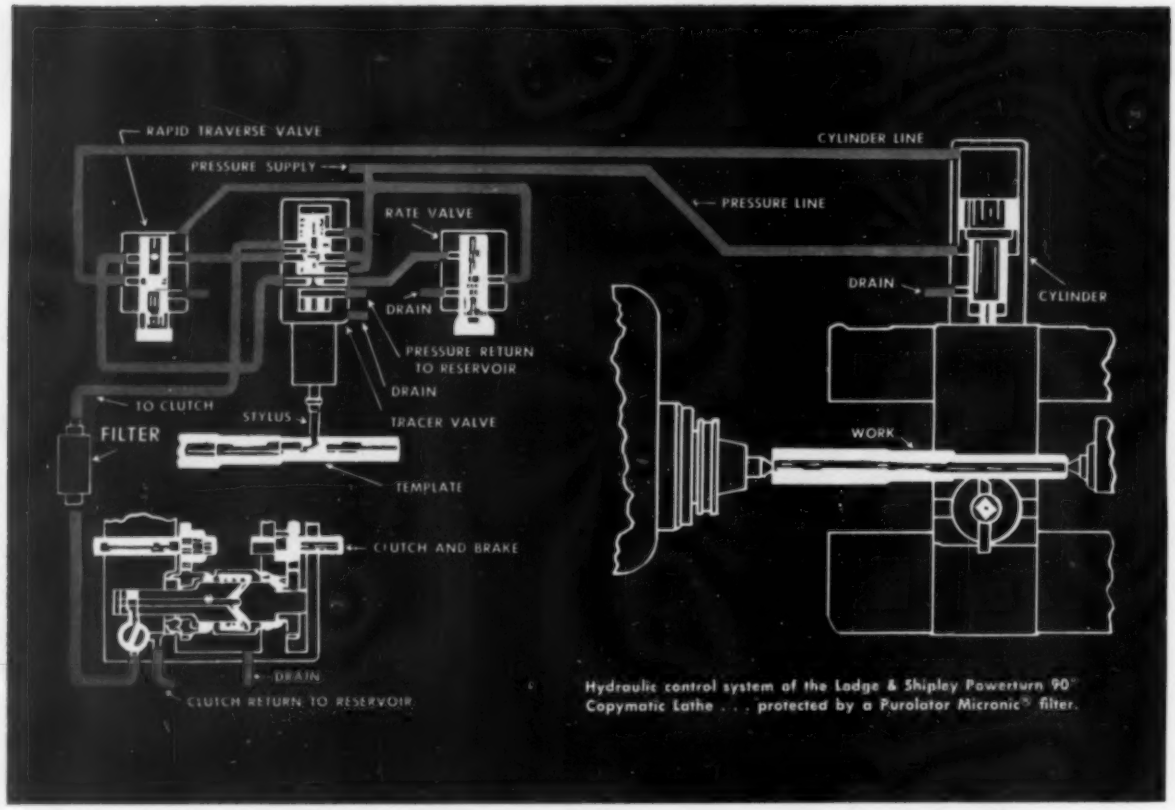
Uneepac comes in two types. Shown here is design for flange widths up to ½" which is used in BS&B Glycol Pump. Large illustration above shows design for flange widths over ½".

Chalk up another success story for Uneepac—Johns-Manville's automatic ring packing. In the BS&B Glycol Pump, fluids handled include triethylene glycol, diethylene glycol, gasoline, and various types of oils, alcohols and petroleum treating chemicals. Working pressures range from 125 psi to 5,500 psi with average operating pressures at 3,000 psi. Yet despite these rugged service conditions, Uneepac has delivered—in Black, Sivalls and Bryson's own words—"very satisfactory service."

Many other packing users have acclaimed J-M Uneepac for its long, trouble-free service. Each ring is a complete packing unit. Fewer rings are needed than ordinarily required and stuffing box size can be reduced to the minimum. Each ring centers itself automatically on the preceding ring to simplify installation. This exclusive design also permits fluid pressure to act upon each lip individually and protects lips from excessive gland pressure.

J-M Uneepac comes in a wide range of styles and sizes for many rod and plunger applications. For further information write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville PACKINGS, GASKETS and TEXTILES



Hydraulic control system of the Lodge & Shipley Powerturn 90° Copymatic Lathe . . . protected by a Purolator Micronic® filter.

Designed for highly accurate control ...fully protected by Purolator Filtration

On a very successful automatic duplicating lathe, this hydraulic control system makes possible both quick, simple operation and a high degree of sensitivity and accuracy. Reliable and uninterrupted operation of a system like this is dependent upon freedom from contaminants. That's why the Lodge and Shipley Company, its manufacturer, made Purolator Micronic® filters an integral part of their hydraulic system.

Purolator engineers recommended a standard filter from their stock of over 2000 models. It more than met the system's special requirements.

The controlled porosity of Purolator's Micronic element evenly filters out contaminant particles as small as .000039 inch. And because it's made of plastic-impregnated cellulose, the Micronic element is not affected by high temperatures, water, or oil.

PUROLATOR

PRODUCTS, INC.

"FIRST IN THE FIELD OF FILTERING"

Rahway, New Jersey and Toronto, Ontario, Canada

Filtering information for product designers is available in our 32 page "Filtration Manual for Product Designers". Just enclose 25¢ to cover postage and handling. Address Dept. P5-26.

CHOICE OF BUILT-IN VALVES GIVES CONTROL FLEXIBILITY

SINGLE AIR CONNECTION SIMPLIFIES INSTALLATION

RUGGED CONSTRUCTION ASSURES LONG LIFE

125 BELLOWS SALES AND SERVICE FIELD ENGINEERS

■ There are one or more Bellows Field Engineers in every industrial area of the United States and Canada. They will be happy to work with you in applying "Controlled-Air-Power" to your machine designs. They are listed in their local phone directories under "The Bellows Co."

758-B

Four reasons why THE BELLOWS AIR MOTOR stands first with design engineers

In designing for air cylinder operation the engineer wants first of all sure, positive control, easily interlocked to related machine movements. **He has it in The Bellows Air Motor.**

He wants simple installation, uncomplicated by cumbersome piping. **He has it in The Bellows Air Motor.**

He wants rugged construction — an air cylinder that will stand up day in and day out with minimum requirements for service and repairs. **He has it in The Bellows Air Motor.**

But he also wants the knowledge, if service should ever be needed, that it is quickly available wherever his machine may go. **He has it in The Bellows Air Motor.**

The Bellows Co.

AKRON 9, OHIO

This free booklet offers interesting data for the design engineer. Write for it today. Address Dept, AH-257. Ask for Bulletin BM-25. The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd.

BRIEFS about fluid power

DOUBLE TRACER LATHE PERMITS SINGLE SET-UP

Work normally turned with multiple tooling, and requiring separate machines for rough and finish operations, can be handled in a single setup on double tracer lathes. Arrangement pioneered by Hydra-Feed engineers mounts the two tracers in a variety of combinations for greatest efficiency on any particular installation. Greater accuracy and time savings result as the workpiece does not have to be handled and chucked twice for separate roughing and finishing operations. Through the use of hydraulics, machining cycles are completely automatic and can be preselected for the particular operation involved.

• **Combinations:** Several basic tracer combinations are possible: Right or left hand mounting, or combination of both; tandem mounting, with a single hydraulic feed cylinder; and individual feed cylinders supplied for each tracer.

• **Sequences:** Two different machining sequences are possible:

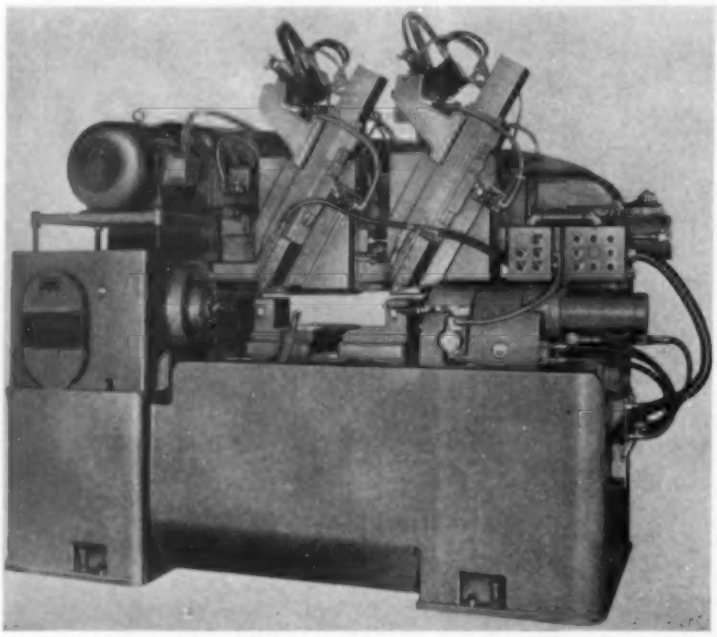
a. Traversing rear carriage operates first to perform multiple tool roughing operations. Then top carriage tracer slides move in for template controlled tracer turning.

b. Top carriage mounted tracers perform their turning. Then the rear slides are used for form tool grooving and undercutting operations.

Operating cycle can be ideally suited to the nature of the part being machined to produce quality work at low cost.

• **Mounting** of the tracer controls and template on the top carriage provides a good arrangement for machining efficiency. The operator has a clear view of tracer stylus, cutting tool and workpiece at all times. All adjustments for setup and tool wear are within easy reach of the operator in his normal work position. Dust and chips will not gather on the vertical slide ways.

Illustration shows two hydraulic cylinders controlling the vertical tool slides accurately and automatically. Top-mounting of tracer controls and template promote machining efficiency. All adjustments are within easy reach of the operator. ▼▼▼

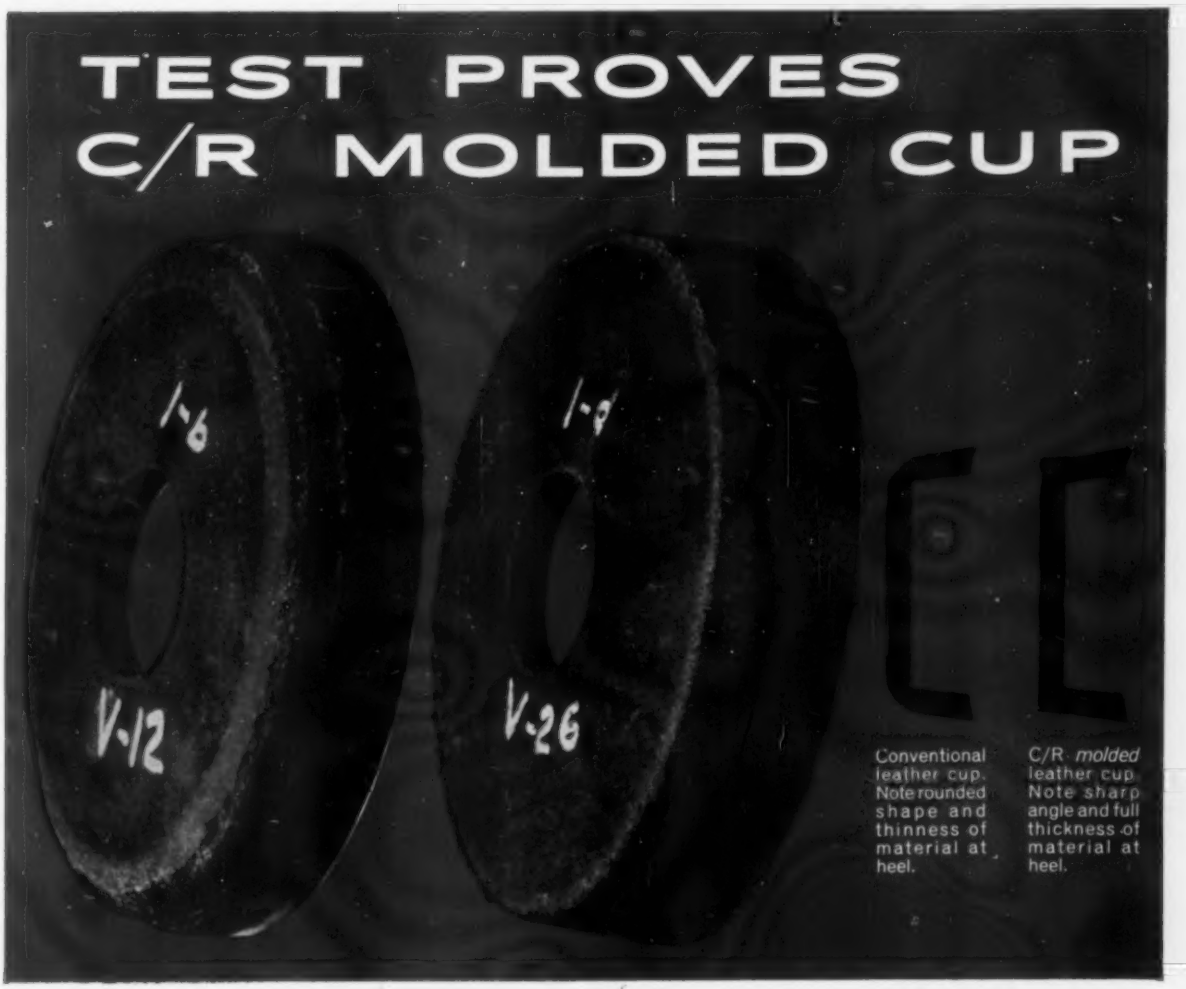


Pneumatic Control of Farm Implements

An air system is powerful enough for smaller tractors, and is commendably free from complications. A recent development, of the David Brown Companies in England, called the "Air-Light" Lift System, has a piston-type compressor direct-coupled to the gear-box input shaft of the tractor.

Continued on page 26

TEST PROVES C/R MOLDED CUP



Conventional leather cup. Note rounded shape and thinness of material at heel.

C/R *molded* leather cup. Note sharp angle and full thickness of material at heel.

New molded C/R cups* stand up longer... cut down replacement costs

Compare the wear on these piston cups shown in the unretouched photographs above. They were tested in a hydraulic cylinder at 6000 p.s.i. for 3000 cycles. The one at the right is a Sirvis-Conpor molded leather cup. The other is a conventional leather cup. Features of the C/R molded cup that make it so obviously superior are greater density, the sharp, rather than rounded heel, and the fact that it is pre-formed to the shape which conventional cups are forced to assume under pressure. This eliminates operational stress and flexing that conventional cups undergo, and contributes greatly to longer service life.

*Available in J.I.C. standard and other popular sizes. Write for complete size list.

Right now, molded C/R cups are providing greatly increased service life in hydraulic cylinders in such heavy duty applications as farm and road building equipment and steel mill equipment at oil pressures up to 3500 p.s.i., and 150 p.s.i. in air cylinders. If you face a difficult packing problem that requires high durability and efficiency . . . it will pay you to consider this new, improved C/R design.

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue Chicago 22, Illinois

Offices in 55 Principal Cities. See your telephone book.

In Canada: Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York

SIRVIS C/R DIVISION
CHICAGO RAWHIDE

Other C/R Products

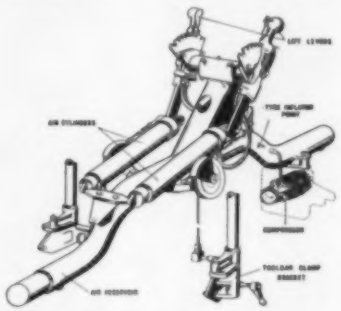
C/R Shaft & End Face Seals • Sirvene (synthetic rubber) molded pliable parts • C/R Non-metallic Gears

BRIEFS continued

PNEUMATIC LIFT SYSTEM in operation on a light tractor with a seeding unit mounted. Implement bar will remain in this position until operator moves the hand lever.

This compressor charges an air pressure reservoir (formed by the tubular main frame member) to a pressure of 100 psi. Relief valve is set to open at 140 psi and close at 80 psi. Operating pressure of 80 psi gives a lifting effort of 300 pounds per ram, of which there are two. Each ram can be individually controlled by its own hand lever operating the air valve. They may be operated simultaneously by one hand lever, after a bolt mechanism has been set to lock both hand levers together.

• **Actuation:** Each control lever is pivoted and moves in a quadrant so that when the top of the lever is moved forward, the lower part swings back. The lower end is connected to the piston of the actuating cylinder and is also linked to the toolbar clamp bracket by means of a cable. Just below the pivot point is housed the air valve, whose operating plunger projects from each side of its body. Attached to the hand lever are two lugs carrying adjustable tappets which are in line with the operating plunger of the valve. These tappets are so adjusted that slight forward movement of the hand lever causes displacement of the valve spool from neutral into pressure-to-arm setting. Conversely, backward movement of hand lever causes the other tappet to move the valve plunger into "exhaust" position.



AIR RESERVOIR is part of the frame. Rams, hand levers and air valves are located on each side of the reservoir.

• **Power Assisted:** In effect, this arrangement gievs servo-actuation of the implement control rams. Being linked to both hand levers and tool-bar linkage, the rams assist the movement of the levers. Air is only fed to the cylinders so long as the pressure of the hand is maintained keeping the tappet against the valve spool and holding it open. When the operator's hand is removed from the lever, the valve plunger is centered and traps the air in the cylinder, locking the rams in the desired position. J.A.L. ▼▼▼

IDEAS IN BRIEF

AIR MOTOR TILTS PRESS . . . A rotary air motor driving an inclining nut through a high ratio worm gear moves the press frame on inclinable presses. It's optional equipment for Niagara O.B.I. presses of 45 to 200 ton capacities. 85 psi air acts to move the press frame through a 30 degree angle in about 2 minutes.

THIS MONTH'S NEW COMPONENT . . . Introduced just in time to tie-in with this month's cover theme, *Fluid Motors for Spindle Drives*, is a new torque booster made by the Char-Lynn Company. Details of this unit are given in the new product columns. It has many more applications than for machine tool spindle drives.

BETTER SERVICE . . . MORE FLUID POWER . . . The two go hand-in-hand. Many air and hydraulic component manufacturers are increasing their service facilities to give users prompt help. Here's the sort of action being taken. Greer Hydraulics has integrated its spare parts function into its service department. Service engineers have been assigned to district sales offices to handle all local service inquiries.

SELLING THE MACHINE TOOL BUILDER . . . What's the outlook for fluid power on machine tools during 1957? NMTBA expect 1957 machine tool shipments to equal if not exceed 1956. And 1956 was a good year—over $900,000,000 in new orders. There's some talk that the industrial machinery industry can be called a growth industry.

AIR SPRINGS . . . Cadillac's 1957 Eldorado Brougham is the first American car with air springs. The spring is a rubber and nylon fabric diaphragm which is fitted onto the open end of a metal air tank and held in place by air pressure. One air spring is used at each wheel. They replace metal coil and leaf springs. A metal piston for each diaphragm, air valves and air compressors are included in the air spring system.

Fluid Powered Transfer Machine

Using the design advantages of hydraulics, this machine mills, hollow mills, drills, spot-faces, taps and reams steering knuckles at a net production rate of 146 pieces per hour. Unit is a 26-station, segmented, palletized transfer ma-

Continued on page 28

Simple • Versatile • Compact

NUMATICS

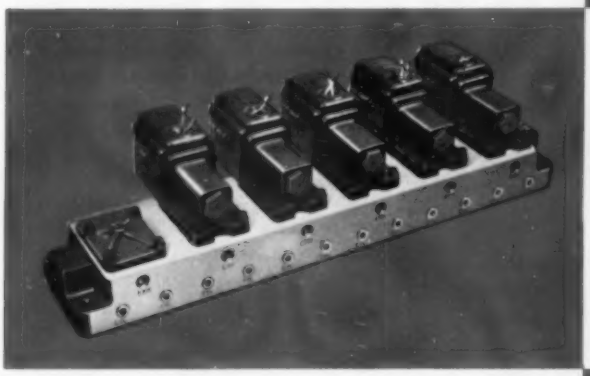
MULTIPLE MOUNT MANIFOLDS

YOU ASKED FOR IT!

Numatics research, engineering and production have come up with it—a new, simplified, streamlined series of manifolds for multiple mounting, piping and wiring solenoid-operated air valves. They're compactly built, quickly installed, readily accessible, easily maintained. They're available in ¼", ⅜", ½" and ¾" valve pipe sizes in from two to six stations—and all valve actions in Numatics SA Series may be mounted interchangeably on any manifold station. In a word, Numatics new manifolds provide the flexibility, efficiency and economy you've been looking for in a control system.

C SERIES MANIFOLD—

Designed to eliminate separate electrical pull boxes and the confusion of numerous conduit runs, Numatics Conduit Manifold may be used with either M or H Series air manifolds. A selection of from 3 to 6 stations is offered—and all valve actions, in ¼" and ⅜" pipe sizes, are interchangeably mountable on any station. Further, once assembled, the basic installation need never be disturbed, as individual access to any valve in the group is provided for by separate cover plates.

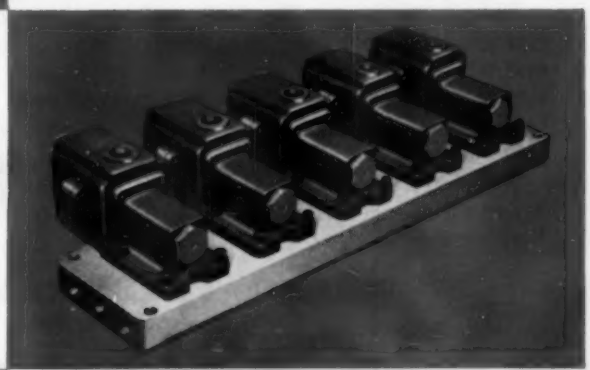


M SERIES MANIFOLD—

For the ultimate in piping flexibility, Numatics offers the Individual Exhaust Manifold Series. The common supply passage, running the length of the manifold, is threaded at both ends. Each exhaust port is threaded one side and bottom . . . allowing unit to be piped from any side or combination of sides. Available in three sizes . . . A for ¼" and ⅜" valves, B for ½" valves, C for ¾" valves—in a minimum of 2, a maximum of 6 stations.

H SERIES MANIFOLD—

Where it is desirable to have all exhausts manifolded into common exhaust chambers, use Numatics H Series Manifold. All exhaust ports join into two exhaust passages which run the length of the unit and parallel to the common supply passage. Exhaust and supply ports are threaded at both ends . . . cylinder ports are threaded in the bottom face, thus permitting piping from the bottom only. H Series manifolds are offered in ¼" and ⅜" sizes in from 3 to 6 stations.



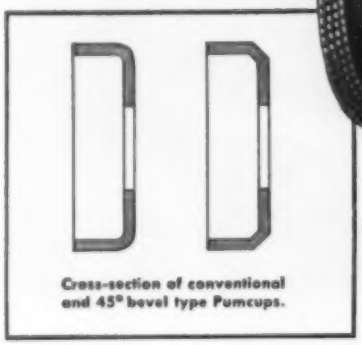
[illegible] to page catalog containing descriptions, illustrations and complete specifications on Numatics' new manifolds, SA Series valves and control accessories. It's Catalog 5000—send for your free copy today!

NUMATICS, Inc.

MILFORD • MICHIGAN

DEPT. AH

2-way gain with Pumcups



Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

Why not check these claims right in your own plant? Meanwhile get *all* the facts. Just send for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

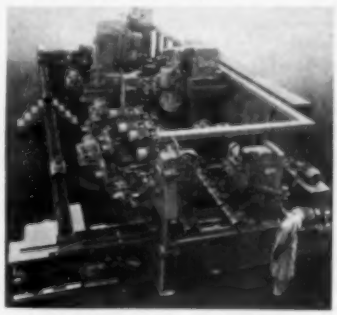
DARCOVA — THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

BRIEFS / continued

chine, designed and built by Snyder Tool & Engineering Co.

• **Hydraulic Clamping**—Two parts at a time are clamped in pallet-type fixtures and removed from station to station in the machining section with a transfer mechanism. Pallets are returned to the first machining operation by a motorized conveyor through a wash and



blow-off operation. A unique, automatic fixture-clamping method speeds clamping and unclamping operations, assuring that forgings are clamped in a position providing uniform stock removal from all machined faces. Parts are located in the fixtures by initially holding them down against V-locators with hydraulic cylinders. Then spring-operated jacks are hydraulically released and air wrenches automatically clamp the part.

• **Separate Controls**—All machine operations are performed with units having individual bases and individual control panels. This simplifies maintenance problems and provides maximum flexibility for part design changes. ▼▼▼

Air-Powered Press Feed Mounts Without Attachments

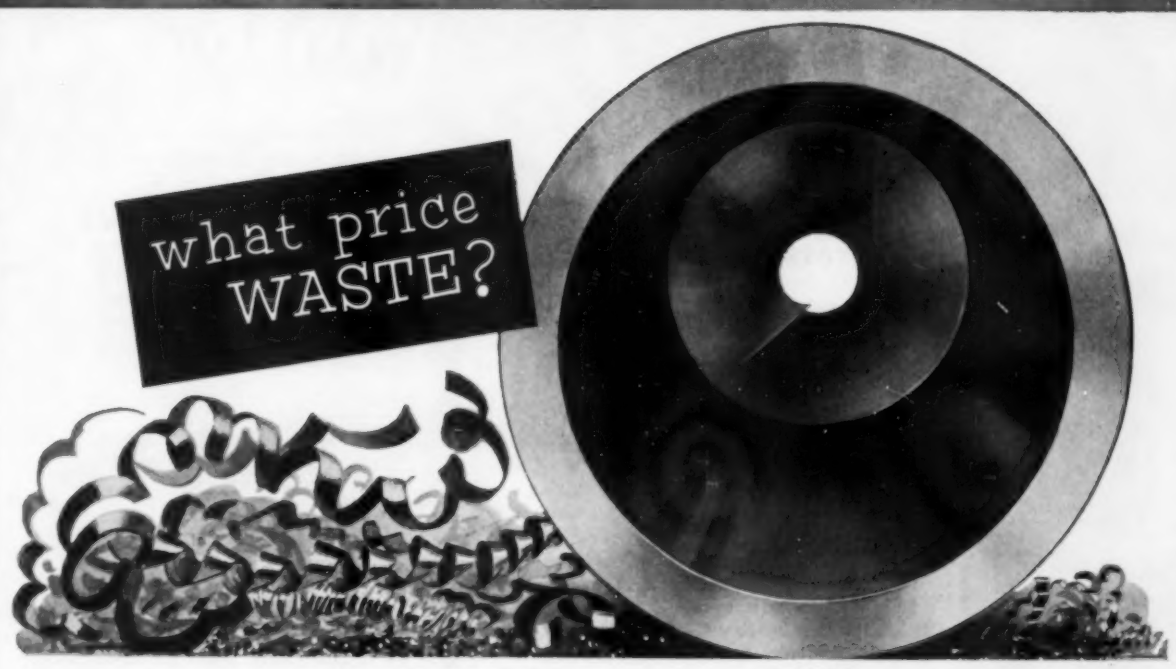
• **Greater Mobility**—Air-operated units for feeding coiled stock into punch presses have been designed by Special Engineering Service, Inc.

Units are designed for direct mounting to the bolster plate of the press. It is only necessary to mount a valve so that the valve

Continued on page 30

Circle 29 on Reader Service Card

Circle 14 ⟶



save money, minutes, metal

with B&W MECHANICAL TUBING

CARBON • ALLOY • STAINLESS

Countless hollow parts and products now being made from solid stock can be fabricated more economically from tubing. The hole is there, eliminating heavy drilling with all its attendant waste. And the wide range of sizes, shapes, analyses, finishes and heat-treated conditions in which B&W Mechanical Tubing is available, make it a semi-finished product in itself — reduce all your machining operations to the minimum.

Get the facts on savings from Mr. Tubes, your link to B&W and your local B&W tubing distributor.

Write for Guide to the Use of Seamless Mechanical Tubing, Technical Bulletin 340.

The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels

TA-5031 (C)

For pressures to 5,000 psi

STRATOFLEX HOSE and FITTINGS

meet your specs

When you design with Stratoflex you get more than the vibration and stress resistance inherent in flexible hose. You get hose fittings designed to meet your specific requirements. Stratoflex hose and fittings are available in a wide range of types and sizes . . . lightweight for aircraft use . . . corrosion resistant for marine applications . . . Teflon* for extremely high or low temperatures . . . heavy duty, double-wire braid types for high pressure. Stratoflex leak-proof, reusable fittings make possible quick, easy replacement or modification. You simplify both design and maintenance when you specify Stratoflex.

*TEFLON is a registered DuPont trademark.

TYPICAL ASSEMBLIES

SF 212 DOUBLE WIRE BRAID HOSE with SF 320 REUSABLE SWIVEL FITTING for high pressure applications. Working pressure range: 1,125 to 5,000 psi.

SF 211 SINGLE WIRE BRAID HOSE with SF 319 REUSABLE SWIVEL FITTING for medium pressure applications. Working pressure range: 350 to 2,000 psi.

SF 124 TEFLON HOSE with SF 524 SWAGED FITTING for aircraft applications. Stays flexible from −100° to +450° F. Unaffected by all fuels, petroleum, synthetic base lubricants, acids, and solvents.

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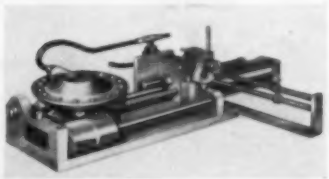
BRIEFS continued

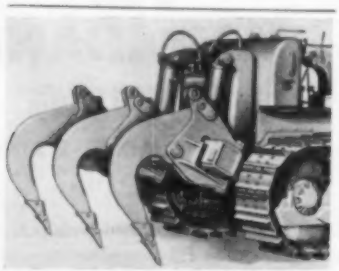
will be tripped by some moving part of the press ram or die.

• **Operation**—Coiled stock being fed is guided at both the front and rear of the air feed. A diaphragm gripper assembly is connected to the end of the feed cylinder and guided on rigid bars. On a signal from the press, this



assembly grips the stock with approximately 1600 lbs pressure along one edge of its width. This gripper then pulls the stock forward to the end of the feed stroke, where it is released. During the return of the diaphragm gripper head, the stock is retained securely and prevented from slipping by a self-adjusting mechanical stock retainer. Stock is always fed on the up-stroke of the press. A self-contained hydraulic check device serves to cushion the feed stroke impact on each end. In addition, metal-to-metal stops insure close tolerance duplication of stroke length at every cycle in the operation. ▼▼▼

Continued on page 32



Two mounting brackets, two hydraulic cylinders, one beam assembly, and three teeth make up the new tractor-mounted ripper, designed by Caterpillar Tractor Co. The ripper is operated hydraulically by the two hydraulic cylinders working in conjunction with the tractor's hydraulic control. The ripper is driven from a "live-drive" hydraulic pump which permits the ripper to be raised and lowered independently of the flywheel clutch or torque converter. A convenient control feature is the automatic kickout which throws the hydraulic control lever back to "hold" position at the end of the raise stroke.

Circle 99 on Reader Service Card

Circle 66 ⟶

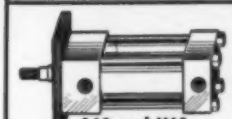
over 8,000 Different Cylinder SELECTIONS—

Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery..

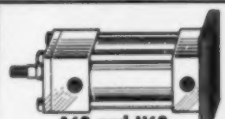
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

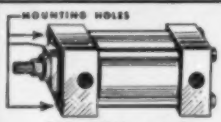
"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.



A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)



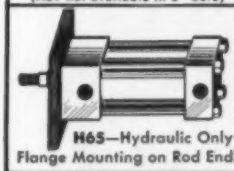
A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



A63—8" Bore only
Flange Mounting on Rod End

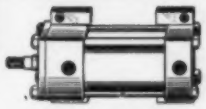
A64—8" Bore only
Flange Mounting on Cap End

A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.

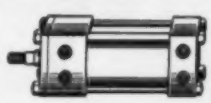


H65—Hydraulic Only
Flange Mounting on Rod End

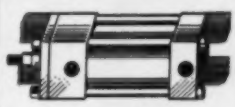
H66—Hydraulic Only
Flange Mounting on Cap End



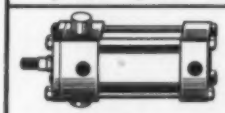
A72 and H72
Side Lug Mounting



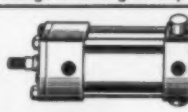
A74 and H74
Side Flush Mounting



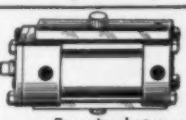
A77 and H77
Side or Foot Mounting



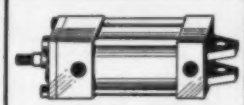
A81 and H81 Trunnion Mounting on Rod End



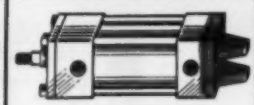
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches — "IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		Strokes
AIR	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	6	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	8	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned	3 4 5 6 7 8 9 10 11 12
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12
	2	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	2½	1"	¾-16	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	3¼	1⅜"	1-14	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	4	1¾"	1¼-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
	5	2"	1½-12	Cushioned	3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36
				Non-Cush.	1 2 3 4 5 6 7 8 9 10 11 12 14 16 18 20 22 24 28 32 36

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

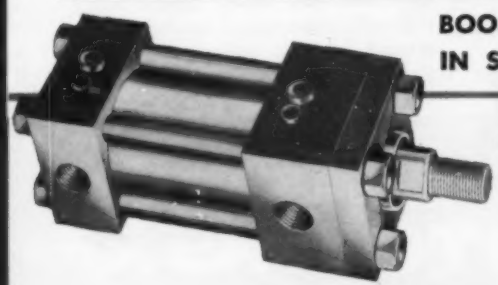
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

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FLICK-REEDY CORP.

Miller

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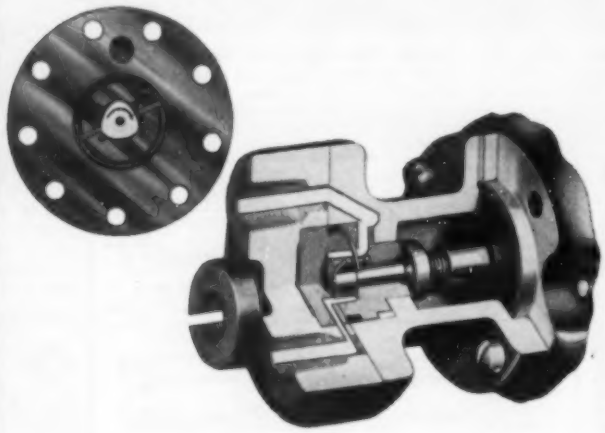
Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.

Compact • Light Weight

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

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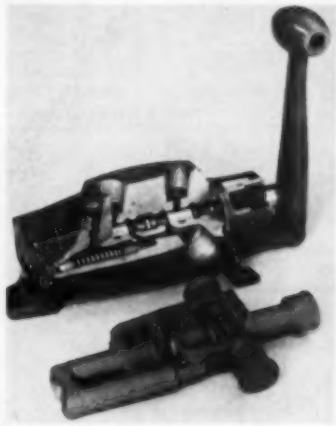
BRIEFS / continued

Unusual Die Casting Technique Makes Hydraulic Valve

• **For rugged service**—Design of a hydraulic valve that would protect any system against excessive pressure for a range of operation up to 2000 psi and surge pressures reaching a possible 5000 psi, and in which valve volume capacity had to range from 2 gpm to well above 12 gpm, was the job facing engineers of the Char-Lynn Company.



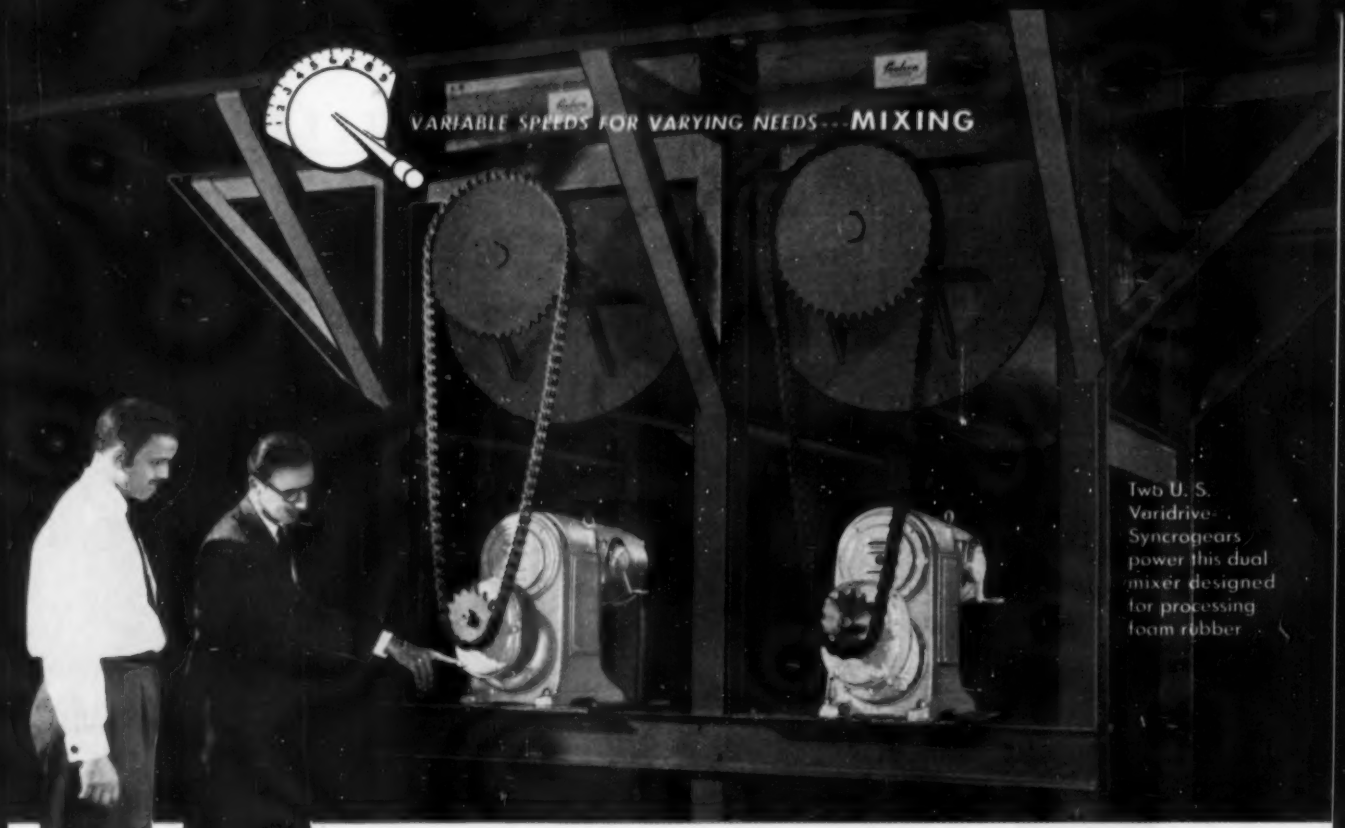
In foreground is zinc core, around which aluminum die cast valve body is cast. Cutaway of the valve shows detail and severe undercuts.

• **Cast-in advantages**—Standard coring techniques for the production of this valve were found impractical, and a new technique had to be developed to facilitate coring of the intricate aluminum die cast valve body. Coring is accomplished by first casting a zinc core. The zinc core is then coated with an insulating material and positioned in the valve body die, and the aluminum is then injected in the normal manner. The coring of blind holes, undercuts, and other heretofore difficult operations is accomplished by this technique. Machining is minimized, and only operations are tapping of the ports and boring for the center spool. There are no drilled holes to plug,

Continued on page 34

Circle 116 on Reader Service Card

Circle 106



Two U. S. Varidrive-Syncrogears power this dual mixer designed for processing foam rubber

Question: **"WHY DOES VARIABLE SPEED IMPROVE MIXING?"**

Answer: **"BECAUSE THERE'S ONE RIGHT SPEED FOR EVERY MIXING CONDITION—"** *for example:*

VISCOUS MATERIALS Where dry ingredients are mixed or reacted with vehicles or binders, the materials may go through a plastic state in their reaction; therefore variable speed increases or decreases rpm speed to accommodate the process requirements.

TEMPERATURE VARIATIONS When liquids or semi-solids undergoing mixing lose heat, the speed of the mixer may require reduction progressively or in steps. A Varidrive will give you the precise speeds needed at different levels of temperature.

BATCH BLENDING Different consistencies of batch materials may require slow speed to start, but when they become integrated, higher speed may be applied to reduce time. The same mixer can be used for processing materials of widely varying consistencies by powering it with a Varidrive. Thus you save space and extra equipment.

EXPERIMENTAL PROCESSES You may want to mix new compounds or blends to determine how slow or fast you should make up the batch. Only by variable speed can you get the sensitive rpm needed for experimenting. Varidrive is the answer.

INCREASED VERSATILITY A mixer can be used for many operations with variable speed, whereas a single-speed will restrict its use. A Varidrive gives a mixer its full potential of performance so that you may be able to avoid purchase of extra mixers.

U.S. Electrical MOTORS

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¼ to 60 hp—2 to 10,000 RPM

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Engineered for easy, efficient engine and airframe installation and manufactured for dependable performance, Flex-O-Tube Teflon hose assemblies are ideal for many other severe operating conditions.

Every assembly combines the exclusive properties of Teflon with the strength of stainless steel wire braid reinforcement and the trouble-free performance of factory crimped-on fittings. And every Flex-O-Tube Teflon hose assembly gives you these important features:

- Handles synthetic oils, fuels, nitric acid and propellants from —100°F to +500°F.
- Makes lighter, thinner, more compact aircraft plumbing with practically unlimited operating life.
- Safe up to 1,500 psi working pressure, depending upon size.
- Preformed lines save space and weight, increase flexibility and are easily installed.
- Stainless steel, steel and aluminum crimped-on fittings are leakfree and blowoff proof.
- Unlimited storage life.

Flex-O-Tube Teflon hose assemblies are also the answer for industrial uses where lines are subjected to chemical attack or high temperatures and for use where clean, non-fouling inner walls are required, as in handling foods, beverages and drugs. For the solution to *your* hose problem, send details or prints to our Engineering Department. You'll receive recommendations and quotations from Flex-O-Tube . . . hose coupling specialists for more than 25 years.

HOSE, HOSE ASSEMBLIES AND FITTINGS FOR EVERY AIRCRAFT, AUTOMOTIVE AND INDUSTRIAL REQUIREMENT

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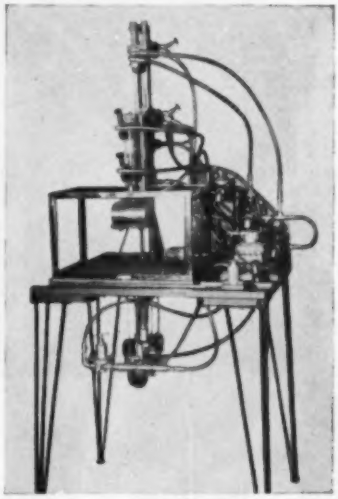
BRIEFS continued

and no drilling for holes is necessary.

Since the valve design can be formed around the zinc core, this casting method will allow a greater freedom for the industrial designer. ▼▼▼



Air-operated machine checks barrels for leaks. By actuating the palm button valve, a series of valves operate the mechanism which lowers the barrel into a tank of water. At the same time, another cylinder plugs the barrel, forcing air into the unit. After a pre-set time the valves reverse themselves, allowing the mechanism to raise the barrel out of the water. This is a miniature model of a standard machine. Courtesy Ross Operating Valve Co.

Broaching Machine Has Self-Contained Hydraulic System

This pull-down broaching machine has been built to provide maximum tooling flexibility and easy maintenance in vertical, internal broaching applications. It is hydraulically operated and electrically controlled. American Broach & Machine Co. designed and built this unit with all components interlocked to provide continuous automatic operation.

• **Easier Maintenance**—Hydraulic systems are self-contained and are located outside the ma-

Continued on page 36

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. . . equipped with VICKERS® hydraulics

Vital ordnance, navigational and deck equipment aboard the USS Forrestal and sister supercarriers depend on the reliability of hydraulic systems designed and furnished by Waterbury Tool. Included are power units on ammunition carriers, elevators, steering gear, anchor windlasses and winches.

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Waterbury Tool can usually provide exactly the right hydraulic system (or hydraulic unit) to give the *best* solution for your problem. We can now supply directly all Vickers hydraulic products (if the end use is for marine and ground defense purposes), as well as Waterbury axial-piston pumps, motors and transmissions.

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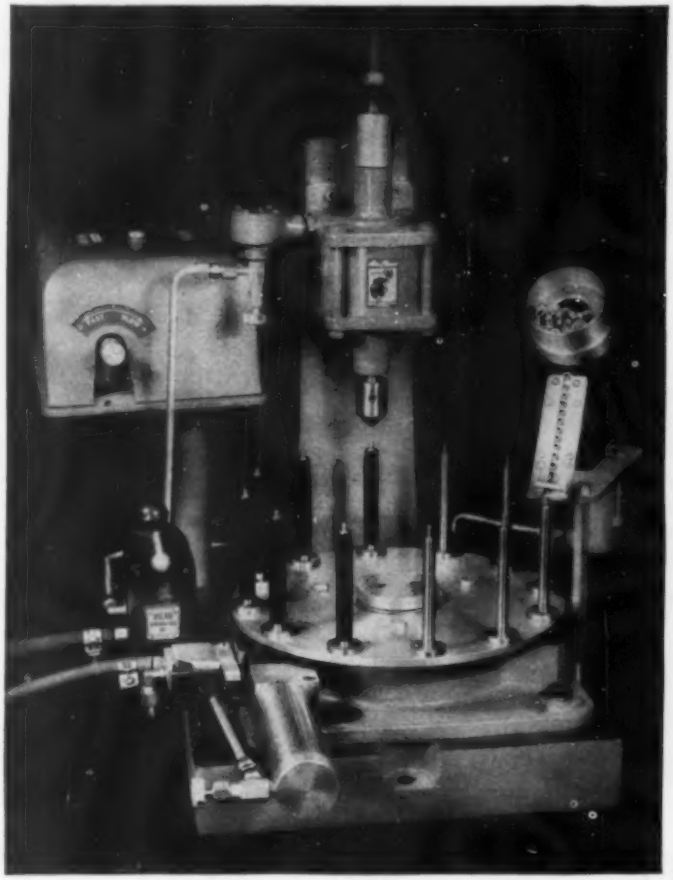
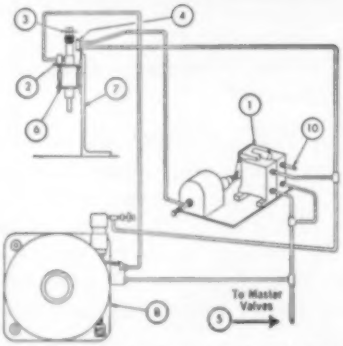
HYDRAULIC PRODUCTS FOR MARINE AND GROUND DEFENSE APPLICATIONS

Automation With Air Power





Circuit Diagrams of Units in This Photo Combine readily to feed work to drill press, air impact hammer for a wide variety of operations.

MEAD Rotary Work Feeder is the heart of this machine to crimp eyelets and rings on pen barrels. A simple combination of standard Mead units makes a semi-automatic machine—operator merely loads.

The **ROTARY WORK FEEDER** Indexes to 8, 12 or 24 stations, at speeds from 15 to 150 stations per minute. Auxiliary valve actuates drill press feed or other pneumatic tool as each station indexes.

(1) Meadmatic Timer controls cycles per minute and "dwell". (2) Speed control valve and quick exhaust valve regulate advance and retraction of tool. (3) Adjustable depth stop. (6) Single-acting air cylinder. (7) Vertical stand. (8) Rotary Work Feeder. All units mounted on Universal Base.

MEAD

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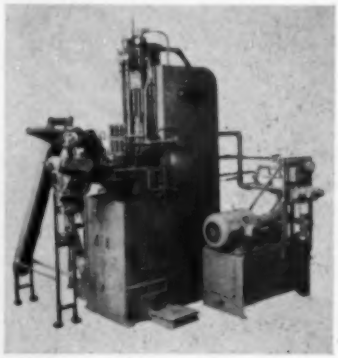
SPECIALTIES COMPANY, 4114 N. Knox, Dept. AH-27, Chicago 41, Illinois

PATHFINDER IN AIR POWER AUTOMATION

BRIEFS continued

chine column, allowing a wide range of tooling adaptation. Large work table provides rigid support with minimum deflection for simple tooling as well as for dial index type unit. Hinged splash guards under the table open completely to give clear access to



broach puller assembly and coolant sump. Fixed main cylinder is constructed to operate a massive slide travelling on hardened and ground rectangular ways in the machine column.

• **Modifications**—Machine can be tooled with radially locked pullers, hydraulically actuated and electrically interlocked to the machine cycle. This assures that broaches are positively locked in the pullers before machine cycle can continue. ▼▼▼

Hydraulic System Permits Fine Finish

Where production does not warrant purchasing a wide belt sheet polisher, it is possible for any stainless steel fabricator to use this

hydraulic automatic-stroke polisher. Either 2B roll mill sheets, or formed flat surfaces, can be pol-

Continued on page 38

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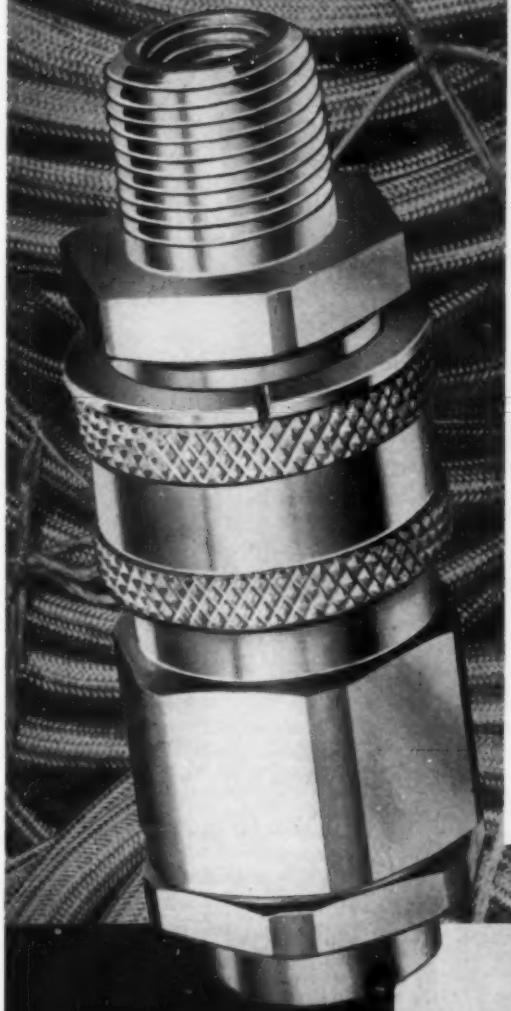

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Hose sizes: 3/16" to 3" Coupling sizes: ¼" to 12"

**Other tough conveyance problems are solved with Titeflex flexible hose made of TEFLON—a Du Pont tetrafluoroethylene resin—in sizes of ¼" to 7¼"*

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BRIEFS continued

ished to an equivalent #4 finish, or better.

• **Long Strokes**—Designed by the engineering staff of the Curtis Machine Division of The Carborundum Company, the hydraulic system powers a traveling head at 80 to 90 eight-foot strokes per minute. Longer strokes are possible. A buff roll mounted on the traveling head backs up the 6-inch wide abrasive belt with grind pressure, either by manual or air pressure control. ▼▼▼

1956 ASME Award

Harry F. Vickers (right) receives the ASME Medal for 1956 from incoming president Dr. W. F. Ryan at the Annual Meeting of the American Society of Mechanical Engineers, held in November in New York City. The ASME Medal has been awarded annually since 1920 for distinguished service in engineering and science. Vickers was cited in particular for pioneering in industrial oil hydraulics and for notable accomplishments in business leadership. He is president of Sperry Rand Corporation and founder of Vickers Incorporated. ▼▼▼

Hydraulic Rotary Actuator Powers Bending Operation

High-speed, automatic tube bending, in a 4-second cycle, without any operator handling, is

Continued on page 40

"We've had excellent fabricating and field results with Republic ELECTRUNITE Hydraulic Line Tubing"

says **E. C. CHRISTMAN,** *Chief Engineer,*
HUBER-WARCO CO.

"Our graders and rollers have established a fine record for trouble-free service," continues Mr. Christman. "Due credit should be given to Republic ELECTRUNITE® Hydraulic Line Tubing used in our hydraulic systems. Our normal operating pressures in this tubing are from 700 psi to 800 psi, with surge loads as high as 2000 psi. Republic ELECTRUNITE handles these requirements with ease."

Huber-Warco Co., a leading manufacturer of heavy-duty road-grading equipment, is typical of others who have had good experience with Republic ELECTRUNITE Hydraulic Line Tubing. They have found that where severe flaring of the ends might crack or split ordinary tubing, Republic ELECTRUNITE's uniform ductility and uniform wall thickness will prevent this. The result is a superior seal at the fittings.

Republic welded tubing is produced to a highly restrictive specification, the result of knowledge gained in the manufacture of critical ammunition components. Its ability to provide unsurpassed performance in all high pressure applications is due in part to specialized manufacturing techniques developed in years of research and experience. Formed from flat-rolled, highly ductile steel, the tube has excellent bending and flaring characteristics, is not subject to longitudinal and transverse cracks.

Get the facts on how Republic ELECTRUNITE Hydraulic Line Tubing can sharply reduce maintenance costs. Available in a wide range of sizes and wall thicknesses regularly used in hydraulic applications. Fits all standard fittings and accessories. Send coupon for complete information.

This close-up view of the saddle in Huber-Warco's powerful 5D-190 Motor Grader shows a portion of Republic ELECTRUNITE Hydraulic Line Tubing assembly which transmits power to blade. Exclusive Huber-Warco design permits 90° blade movement without leaving cab.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
STEEL and TUBES DIVISION
Dept. C-3041
211 East 131st Street • Cleveland 8, Ohio

I would like a sales representative to call with complete information on Republic ELECTRUNITE Hydraulic Line Tubing.

Name_____ Title_____

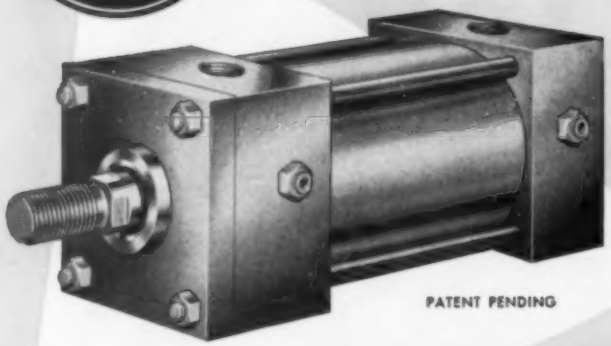
Company_____

Address_____

City_____ Zone____ State_____

FOR AUTOMATION

SP CYLINDERS



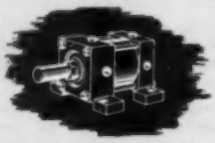
PATENT PENDING

top performance–longest life

All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.

S-P STANDARD AIR CYLINDERS have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

S-P HEAVY DUTY AIR CYLINDERS for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.



S-P HIGH PRESSURE HYDRAULIC CYLINDERS have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

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SP THE S-P MANUFACTURING CORP.

SOLON, OHIO • *IN GREATER CLEVELAND*

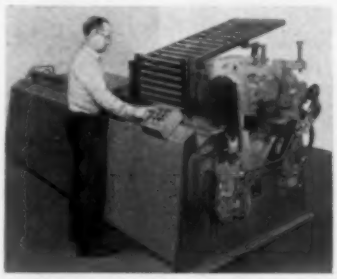
ESTABLISHED 1916 A BASSETT COMPANY

NON ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS
POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

BRIEFS continued

being done on a heavy duty machine designed by Walter P. Hill's engineering staff. This new design utilizes a single-rotation, hydraulic rotary actuator to provide smooth, continuous power throughout the bending operation. Machine bends the tubing in a vertical plane, is compact and provides maximum operator safety.

• **Operation:** For automatic operation, tubes to be bent are loaded in a magazine feed. They are gravity-fed to a position in front of a hydraulic cylinder-operated mandrel. When the cycle button is pressed, the mandrel advances a tube to bending position between the dies. A 3¼-inch diameter clamping cylinder on the die table clamps the tube in the die and the die table is rotated by the actuator. During this process the mandrel returns to pickup position.



HYDRAULIC ROTARY ACTUATOR and die clamping cylinder are shown at right center. Cylinder operating the mandrel feed is at the left. Power units and controls are JIC mounted in base of machine.

A combination of hydraulic, mechanical and electrical stops control the adjustable bend angle. At the end of the bend, the clamping cylinder releases and the operator removes the finish-bent part.

• **Hydraulics:** A two-pump hydraulic system is provided to cut maintenance and avoid slippage. Die table is operated by a 40 gpm, 1000 psi, high-volume, variable-flow pump, powered by a 30 hp motor. A 5 gpm, 2000 psi, low pressure, low volume, positive displacement pump, powered by a 5 hp motor operates the die clamp.

Continued on page 42

Koppers 2-Piece Sealing Rings are installed on hot air shut-off valves manufactured for aircraft by Hydro-Aire, Inc. Ring inners are of stainless steel . . . ring outers are made of high chrome alloy heat resistant cast iron. Diameter is 1¾"

Koppers 2-Piece Rings Solve High Temperature Sealing Problems for Hydro-Aire

A Product of Continuous Research and Development by KOPPERS

To solve a sealing problem at high temperatures, Koppers engineers created a new sealing ring for Hydro-Aire, Inc.

Hydro-Aire, Inc. . . . a subsidiary of Crane Co. . . . manufactures hot air shut-off valves for aircraft applications. Ordinary rubber "O" rings couldn't withstand the high temperatures involved.

Koppers engineers designed a 2-Piece Sealing Ring with extremely close tolerances that provides maximum sealing at high temperatures. Primarily designed for aircraft applications, this new type ring can be used for sealing fuel oil and hydraulic oils as well as hot air and other gases.

The Hydro-Aire application is an interesting example of how highly trained Koppers engineers can solve customers' sealing problems. Koppers engineers in your area will be glad to study your applications and design the proper type of ring.

KOPPERS®

To lower your production costs, bring your ring problems to Koppers. Write to KOPPERS COMPANY, INC., 1502 Hamburg Street, Baltimore 3, Maryland.

RING-TYPE SEALS

Koppers Company, Inc., Metal Products Division
Piston Ring and Seal Department

Engineered* Products Sold with *Service

...another reason

why you can do the job faster, easier with a GREENLEE No. 798-AC Hydraulic Power Pump

This *exclusive* new feature of the GREENLEE No. 798-AC Portable Power Pump . . . two-speed action for *fast approach* to the work and automatic change-over to lower speed, *high-pressure* . . . means big time savings for you. Eliminates costly waiting time for the ram to reach the work . . . makes jobs move fast! The compact *portable* GREENLEE electric motor-driven pump, illustrated, handles a wide variety of hydraulic power requirements wherever needed . . . either for tools in the field or for operating hydraulic rams, jacks, presses, and other systems in the plant or laboratory. Capable of developing continuous pressure of 6,000 psi and up to 10,000 psi intermittent pressure. Powered with ¾-hp constant-speed electric motor, 115- or 230-volt. Dimensions 19" x 10" x 12"; weight 63 lbs. Get facts now on how this new GREENLEE Power Pump can do a better, faster job for you.

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Company_____

Address_____

City and State_____

BRIEFS / continued

Recent Publications

Design Manual—Roller and Silent Chain Drives. Published by the Association of Roller and Silent Chain Manufacturers, Indianapolis. Price $3.50.

Both the theoretical and practical engineering principles involved in the application of chain drives are described, and a good balance between the principles involved in the design of drives and the practical problems of actual installations has been maintained. The Manual will be useful for those who encounter problems of the mechanical transmission of power. ▼▼▼

AIR-HYDRAULICS setup clamps, designed by Wilton Tool, provide low-cost means to automate existing fixtures for increased production. Control shown at right supplies compressed air from factory system to an air-hydraulic booster which exerts force on the PowRlock heads shown in center. Great clamping force provided eliminates chattering and increases tool life.

Designers' Guide Issue

Complete copies of the January 1957 APPLIED HYDRAULICS can be ordered.

Price per copy is 50 cents.

Air and Oil Circuits Guide

This 32 page booklet which appeared in the January issue can be ordered separately in quantities of 10 or more.

Price per copy is:

50 cents for orders of 10 to 99 copies

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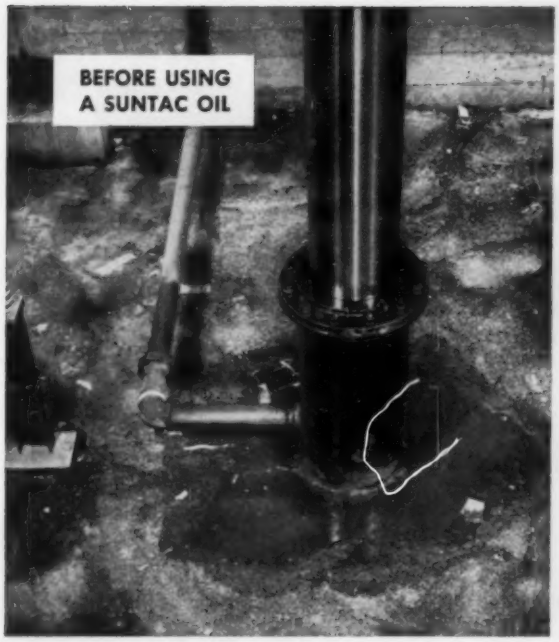
Send your orders to:

APPLIED HYDRAULICS
812 Huron Rd.
Cleveland 15, Ohio



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Before using Suntac oil, a prominent eastern manufacturer had to add excessive make-up oil to the hydraulic system of his freight elevator. Oil leakage caused a continual housekeeping problem...the pit had to be cleaned out every six to eight weeks and maintenance costs were high.

Now, one year after switching to a Suntac oil, make-up has been drastically reduced, and frequent pit clean-ups are no longer necessary.

The reason: Suntac oils are specially compounded oils with adhesive-cohesive characteristics that enable them to cling to parts where other oils would drip, throw-off, leak, and squeeze out.

For complete information about Suntac oils, see your Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-2

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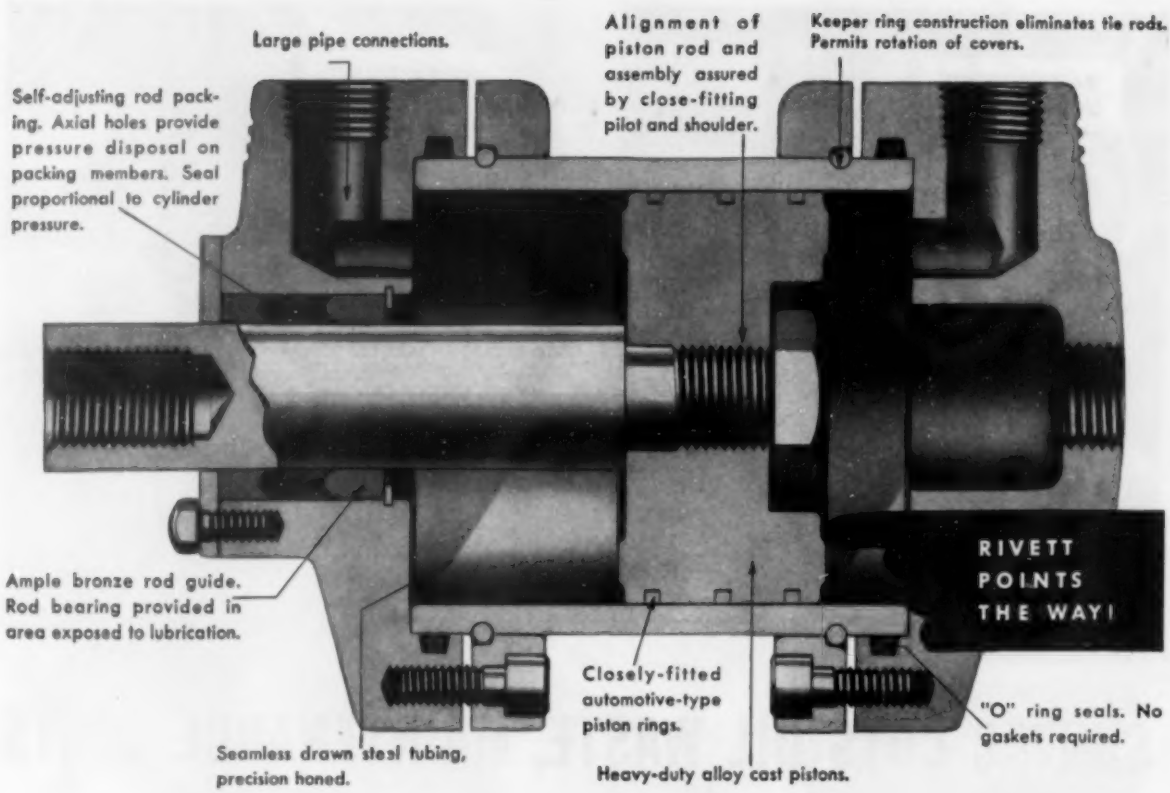

Large pipe connections.
Alignment of piston rod and assembly assured by close-fitting pilot and shoulder.
Keeper ring construction eliminates tie rods. Permits rotation of covers.
Self-adjusting rod packing. Axial holes provide pressure disposal on packing members. Seal proportional to cylinder pressure.
RIVETT POINTS THE WAY!
Ample bronze rod guide. Rod bearing provided in area exposed to lubrication.
Closely-fitted automotive-type piston rings.
"O" ring seals. No gaskets required.
Seamless drawn steel tubing, precision honed.
Heavy-duty alloy cast pistons.

Sealing efficiency improves with increased pressure in Rivett 1500 PSI* Cylinders!

*Higher on application.

- External "O" Rings Act As Static Seals To Eliminate Gaskets And Assure LEAKPROOF OPERATION!
- Automotive Type Piston Rings Reduce Friction, Increase Sealing Ability, Permit Sensitive Response To Any Pressure.
- Keeper Ring Construction Eliminates Tie Rods.
- Self-Adjusting Rod Packing Cuts Friction.
- Unfailing Power For Millions Of Cycles.

1080 SELECTIONS!

7 mountings; 10 bores; standard and 2:1 over-size rod; single and double end rods; internal or external thread; cushioning either or both ends; special covers.

RIVETT, INCORPORATED • Dept. AH-2
Brighton 35, Boston, Mass.

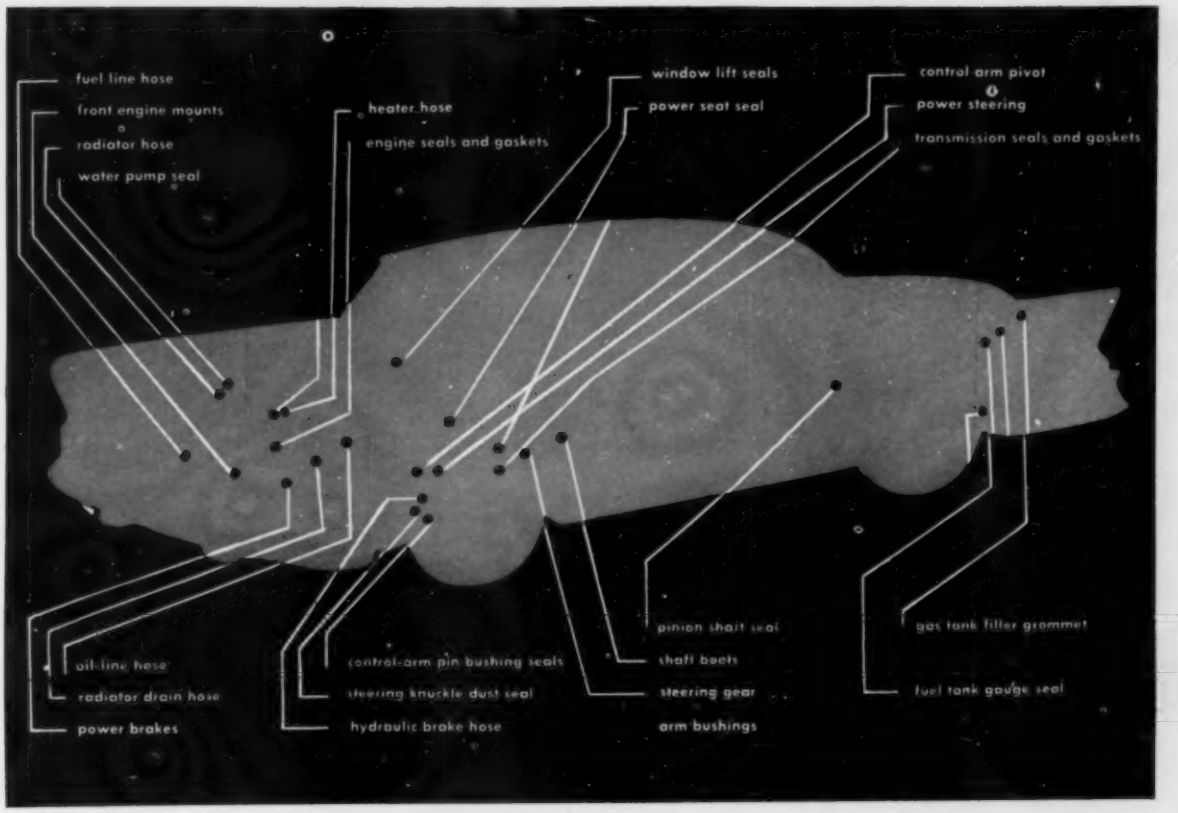
Get Catalog No. 106 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

Member National Fluid Power Association

THE BETTER YOU KNOW HYDRAULICS
THE BETTER YOU LIKE

RIVETT
"100"
HYDRAULIC CYLINDERS

Naugatuck Paracril



Paracril...the oil-resistant, nitrile rubber suited to many automotive applications!

Spelled-out above are just a few applications for Paracril, Naugatuck's butadiene-acrylonitrile copolymer. Unequalled in resistance to oils, fuels and organic esters, aromatic hydrocarbons, chlorinated organic liquids and most hydraulic fluids, the Paracrils provide greater tensile strength with increased dimensional stability, high abrasive resistance, unusual low-temperature flexibility, and excellent resistance to oxidation.

Paracril® stocks are fully compatible with most other rubbers and plastic resins... can be calendered, extruded, or molded by standard rubber forming methods... are easily dissolved in solvents to make low-viscosity solutions for cement applications.

Why not write to us on your company letterhead for application and test data today?

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

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Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

AIR-OIL CYLINDER . . . has 5/8-inch bore

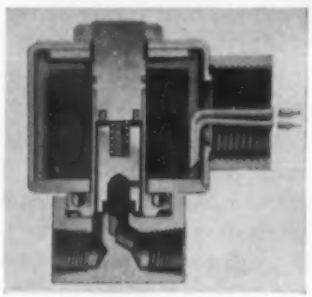
Features: Small size and weight eliminates need for reducing valve on applications where small force outputs are required. For example, force output is only 300 lbs. at 1000 psi line pressure. Force output would be 785 lbs. for one inch diameter cylinder at same pressure. Low volumetric displacement makes possible use of smaller pumps and valves. Inertia is reduced for high speed applications.

Specifications: Available in single or double action models, with low pressure 150 psi air and 750 psi oil, high pressure 1500 psi oil. Mountings include clevis, trunnion, foot, flange or combination. Construction types include brass heads, brass or steel barrels, honed stainless steel piston rod, chevron rod packing and packed piston.

The Airoyal Company
Maplewood, N. J.

Circle 130 on Reader Service Card

SOLENOID VALVE . . . is bubble-tight

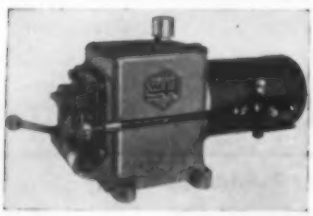


Designation: C-Series
Design: Packless, direct-acting valve with only two moving parts. Positive closing is assured by a spring return.
Application: For control of air, oil or water in fluid power service of all types, including automated machine controls, instruments and lubricating devices and systems.
Features: Body is of brass and compact, rugged construction indicates long life on most applications. Valve can be disassembled for cleaning without removal from the line. Unit is bubble-tight, even on a vacuum.
Specifications: Weight is only 12 ounces. Pipe size is 1/8-inch NPT. Available with orifices from 5/32 to 7/64 inch.

Skinner Electric Valve Division
Skinner Chuck Company
New Britain, Conn.

Circle 131 on Reader Service Card

HYDRAULIC POWER UNIT . . . designed for mobile equipment



Designation: Lectrolift
Features: Unit is self-contained and extremely compact. Consists of a 6 or 12-volt DC motor drive, pump, control valve and tank. Designed for applications on mobile equipment. Reservoir is a rectangular housing of cast aluminum holding 110 cubic inches of oil. Electric motor is flange-mounted to one end of the housing and pump control valve to the opposite end. All working parts are totally enclosed and permanently lubricated. One-lever control can accommodate a clevis for remote control linkage. Unit has 3 operating positions: raise, lower and spring-return to hold. Lowering control is through a throttling valve for varying the rate of return. Mounting can be vertical or horizontal.

Wisconsin Hydraulics, Inc.
Milwaukee, Wis.

Circle 132 on Reader Service Card

Continued on page 48

MORE AND MORE MANUFACTURERS ARE INSTALLING

MARVEL SYNCLINAL FILTERS

AS STANDARD EQUIPMENT

SUMP TYPE (Cutaway)

Manufacturers of hydraulically actuated equipment and others with low pressure liquid circulating systems demand their equipment to perform consistently and with all the productive efficiency they build into the machine that bears their name. Since these systems must be kept free of damaging particles, the selection of a filter is an important factor. Here are some of the outstanding reasons for the increasing preference for Marvel Synclinal Filters to do this all-important job!

BECAUSE . . . Marvels are designed to give maximum ACTIVE filtering area rather than total filtering area. Only ACTIVE FILTERING AREA COUNTS!

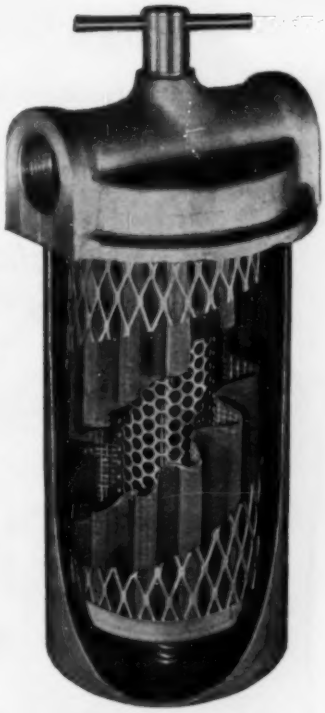
BECAUSE . . . Marvels greater storage space for filtered out particles allows longer periods of "production" time at absolute minimum in maintenance cost and "down-time."

BECAUSE . . . Marvels can be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connection.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration. THEY MEET J. I. C. STANDARDS.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in individual capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to very fine 200, they get a filter to fit their specific requirements.

BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY—shipments are made the same day orders are received, if desired.



LINE TYPE (Cutaway)

FACTS—NOT CLAIMS Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning:

OVER 750 MANUFACTURERS MAKE MARVEL SYNCLINAL FILTERS THEIR O.E.M. CHOICE

For Dependable Protection On All Hydraulic And Low Pressure Systems Investigate MARVEL SYNCLINAL FILTERS

Catalogs containing complete data available on request

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-2)

- ☐ Catalog #107—For Hydraulic Oils, Coolants, Lubricants.
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

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- Built to J.I.C. Recommendations
  (check dimensions below)
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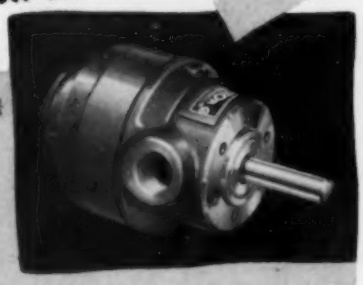
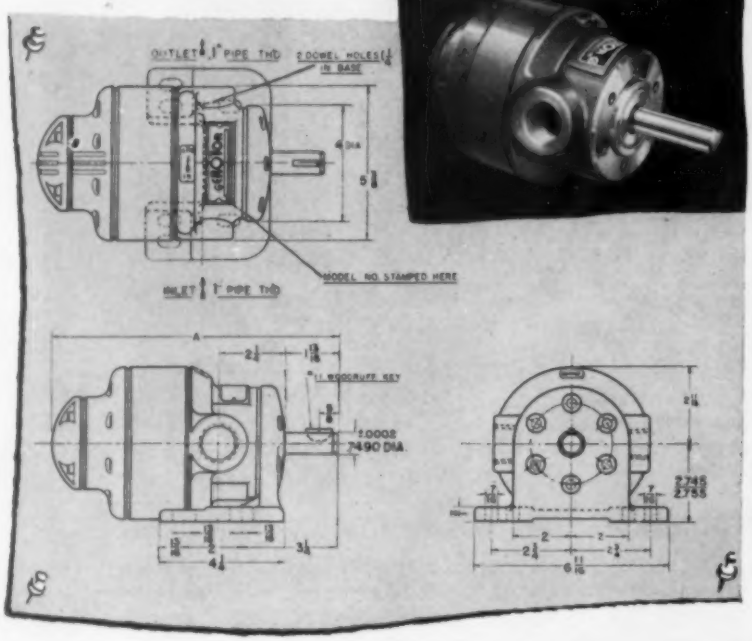
Gerotor Hydraulic Pumps DELIVER more oil for less H.P.





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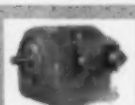
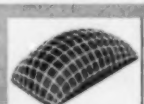
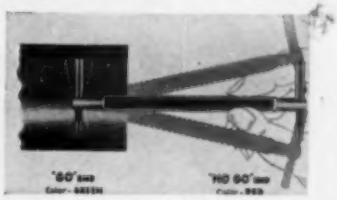

Variable Speed Hydraulic Transmissions


PneuBin—Pneumatic Bin Evacuators

New Products / continued

INTERNAL GAUGE
. . . serves dual purpose

Designation: Holojust
Features: Used as an adjustable limit plug gauge, the unit will check bore diameter, out-of-round and bell-mouth in any spot and any depth up to 5 inches. Bores located one behind another, of equal or unequal diameters, can be accurately



checked. Holes requiring micro finish can be inspected without leaving marks.
Specifications: A full set of 5 gauges will cover range of 7/16 to 2-5/16 inches. Single gauges are available. Handles are of aluminum to provide light weight for sensitive feel. For identification the GO end is green and the NO GO end is red, with the letters stamped on the respective ends.

George Scherr Co., Inc.
New York, N. Y.

Circle 133 on Reader Service Card

JET-COOLANT GENERATOR
. . . features quick assembly

Designation: Jet-Mist
Features: Designed for easier and quicker assembly to all types of machine tools. Pin-points air-liquid

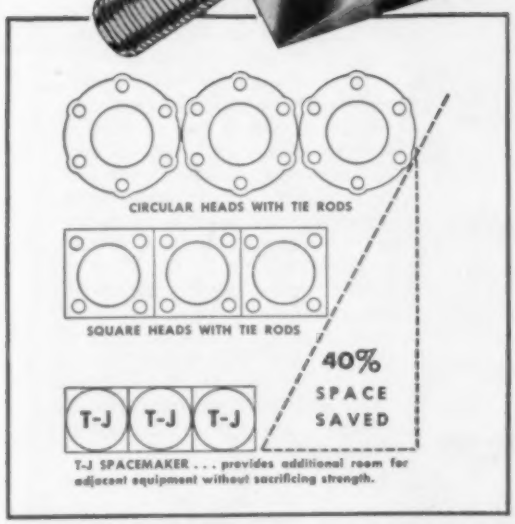
coolants or ail-oil lubricants directly to the cutting area. Simplicity of mounting and operation provide flexible application. Unit does not require pressurized coolant tanks, regulator valves, control panels or special spray heads.
Installation: Unit uses the machine tool sump pump with ¼-inch NPT

Continued on page 50

Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!



NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

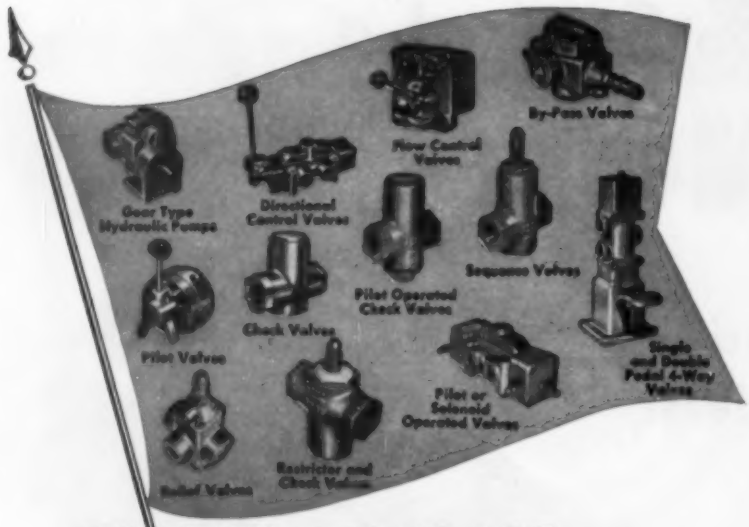
- **NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion**
- **Compact design eliminates tie rods, saves up to 40% space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).**
- **OIL pressure to 750—AIR to 200 P.S.I.**

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J **TOMKINS-JOHNSON**

RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS



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Designers and Engineers have set these standards for Industrial Hydraulic Equipment

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ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

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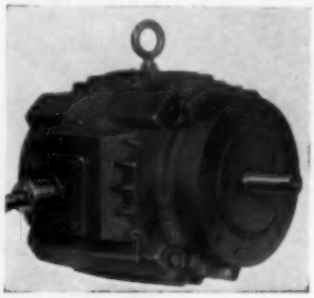
New Products / continued

air line connection for single or multi-jet mist spray. Pressure regulators and pressurized coolant tanks are available for machine tools without sump, or sump pump for flood cooling.

Arrow Tools, Inc.
Chicago, Ill.
Circle 134 on Reader Service Card

A-C MOTORS . . . feature air control

Designation: Air-Over Motor
Design: Motors are totally enclosed and produce varying horsepower by varying air velocities. Effect is accomplished by the cooling effect of the air flow over the motor frame, created by the fan or blower it



powers. Power output can be increased without exceeding the rated temperature rise of the motor.
Features: Units have cast iron ribbed frame construction, oversized double-shielded ball bearings and metermatic lubrication with automatic grease relief. Heavy formvar nylon coated magnet wire is used for coils, with 6 coats of special insulating varnish. Connection is simplified by the leads being numbered and indexed through a neoprene gasket between the frame and conduit box.
Specifications: Motors are available in NEMA frame sizes from ½ through 30 hp and may be operated on 208 volt network systems. Standard model is non-ventilated. Available in explosion-proof Class I, Group D and Class II, Groups E, F and G.

Reliance Electric & Engineering Co.
Cleveland, Ohio
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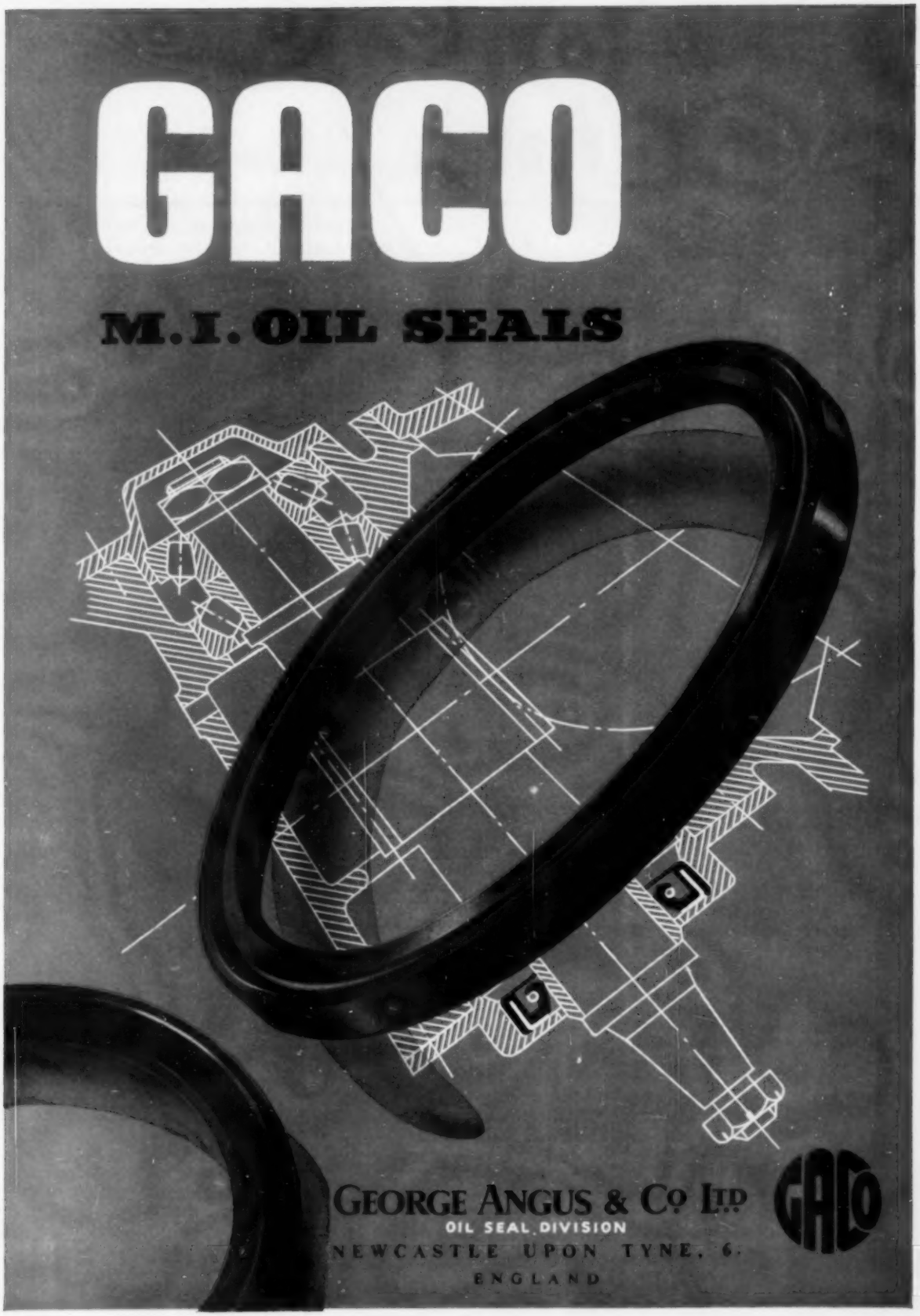
For more NEW PRODUCT reviews turn to page 106

GACO

M.I. OIL SEALS



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Useful Literature

For your free copy of publications reviewed, fill in the reader service card

DUAL RELIEF VALVES . . . for hydraulic service are illustrated and described in new catalog sheets published by Fluid Controls, Inc. Literature is illustrated with schematic drawings of both guided piston and differential piston types. Capacity ranges, pipe sizes, dimensions and typical uses are given. Valves protect hydraulic valves and motors from excessive pressures. Units are applicable to materials handling, road building and mining equipment.

Circle 180 on Reader Service Card

HYDRAULIC CYLINDERS . . . for 2000 to 3000 psi, with 1½ to 12-inch bore, are described by Hydair Cylinder Corporation in Bulletin 101. It gives complete engineering information with illustrations and a large cutaway showing working parts. All mounting data is given in schematic form, and the various combinations of bores and mounts are listed in convenient charts.

Circle 181 on Reader Service Card

FLEXIBLE HOSE ASSEMBLIES . . . for marine use are covered in catalog 301 released by Aeroquip Corporation. Among the numerous products covered are flexible hose assemblies with detachable, reusable fittings of various designs for installation on all commercial and Navy vessels for fuel, air, oil, water and hydraulic lines. These include JIC and SAE fittings, both male pipe and female swivel, and male Walseal fittings. In addition the catalog covers flange fittings, split clamp fittings and new segment socket for large diameter hose installations. Important engineering information and assembly and installation instructions are also given in the catalog.

Circle 182 on Reader Service Card

HYDRAULIC TEST MACHINES . . . portable, self-contained, for functionally testing aircraft and missile hydraulic systems and components, are produced by Consolidated Diesel Electric Corporation's Test Equipment Division. Illustrated literature gives complete information and specifications on test equipment for all applications. Units are quiet, use electrical or gas engine power and operate at pressures to 5000 psi. All fill lines and components are readily accessible for maintenance.

Circle 183 on Reader Service Card

ADJUSTABLE FLOW REGULATOR . . . adapted for manifold mounting, is manufactured by Waterman Engineering Company. Subplate kits are furnished with built-in check valves for free reverse flow. Minimum to maximum flow adjustments can be obtained by 180-degree movement of control handle. Unit is easily installed, weighs only 5 pounds and all exterior aluminum surfaces are anodized. Illustrated bulletin gives details and specifications.

Circle 184 on Reader Service Card

ALUMINUM OXIDE COATINGS . . . applied to metal parts by flame-plating process, offer interesting possibilities for severe service conditions. Possible applications include seals operating under heat and in corrosive mediums, thrust bearings, pump plungers, aircraft parts, guided missile components and heat-resistant, insulated surfaces for electronic components. Material has hardness of 1000 to 1200 VPN, porosity of less than one percent, adheres strongly and coating thickness is from .001 to .040 inches. Literature available from Linde Air Products Company gives engineering and technical data on the material, its properties and applications.

Circle 185 on Reader Service Card

METAL O-RINGS . . . for high temperature, high pressure service where complete sealing is indicated, are manufactured by The Advanced Products Company. Available bulletin gives description and illustrations of the rings, along with schematic drawings showing applications and a graph giving deflection and compression characteristics. Detailed specifications on sizes and materials available are given in tabular form.

Circle 186 on Reader Service Card

SILICONE PRODUCTS . . . almost 150 commercially available types are listed in Dow Corning Corporation's 1957 Reference Guide. Products are grouped by usage, enabling engineers to locate a material by what its does as well as by what it is. Many items are of special interest to fluid power engineers, including compressible fluids, damping media, transducer fluid, pneumatic grease, adhesives and potting compounds. Descriptions are brief and factual, with emphasis on charts, tables and graphs.

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For more reviews of FREE LITERATURE turn to page 114

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QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery

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SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

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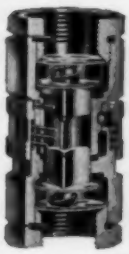

Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

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*Snap-Tite, INC.

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8 reasons

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3) Ucon Hydrolubes can be *safely handled* by workmen.

4) Ucon Hydrolubes are made in *three standard viscosity grades*—200, 300, and 550 S.U.S. at 100°F. Other grades can be supplied to fit specific needs.

5) Ucon Hydrolubes have *high viscosity indexes*—150 to 160.

6) Ucon Hydrolubes are *good lubricants*. Special anti-wear agents provide satisfactory pump life and performance characteristics.

7) Ucon Hydrolubes contain effective liquid and vapor phase *corrosion inhibitors* for the common metals.

8) Ucon Hydrolubes have *low pour points*—a must for use at low temperatures.

Ucon Hydrolubes are the answer to the problem of improved safety with hydraulic fluids. Get all the facts. Write *today* for the booklet "Ucon Hydrolubes Spell Safety," Form 40134.

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A Division of Union Carbide and Carbon Corporation

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Future Events

March 13-15: Spring Meeting National Fluid Power Association. Hollywood Beach Hotel, Hollywood-by-the-Sea, Florida. For information contact Barrett Rogers, Executive Secretary, 1618 Orrington Avenue, Evanston, Ill.

March 20-22: SAE Production Meeting and Forum, Hotel Statler, Buffalo, N. Y.

March 25-27: American Society of Tool Engineers Silver Anniversary Technical Meeting and Convention. Shamrock Hilton Hotel, Houston, Texas. Program Director is L. S. Fletcher, 10700 Puritan Avenue, Detroit 38, Mich.

March 25-29: 10th Western Metal Congress and Exposition. Congress will be held at Ambassador Hotel, exposition at Pan-Pacific Auditorium, Los Angeles, Calif.

April 2-5: SAE Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display, Hotel Commodore, New York, N. Y.

April 8-12: Annual National Spring Meeting of the American Welding Society. Hotel Sheraton, Philadelphia. For information write Robert T. Kenworthy, Exposition Management 12 East 41 St., New York 17, N. Y.

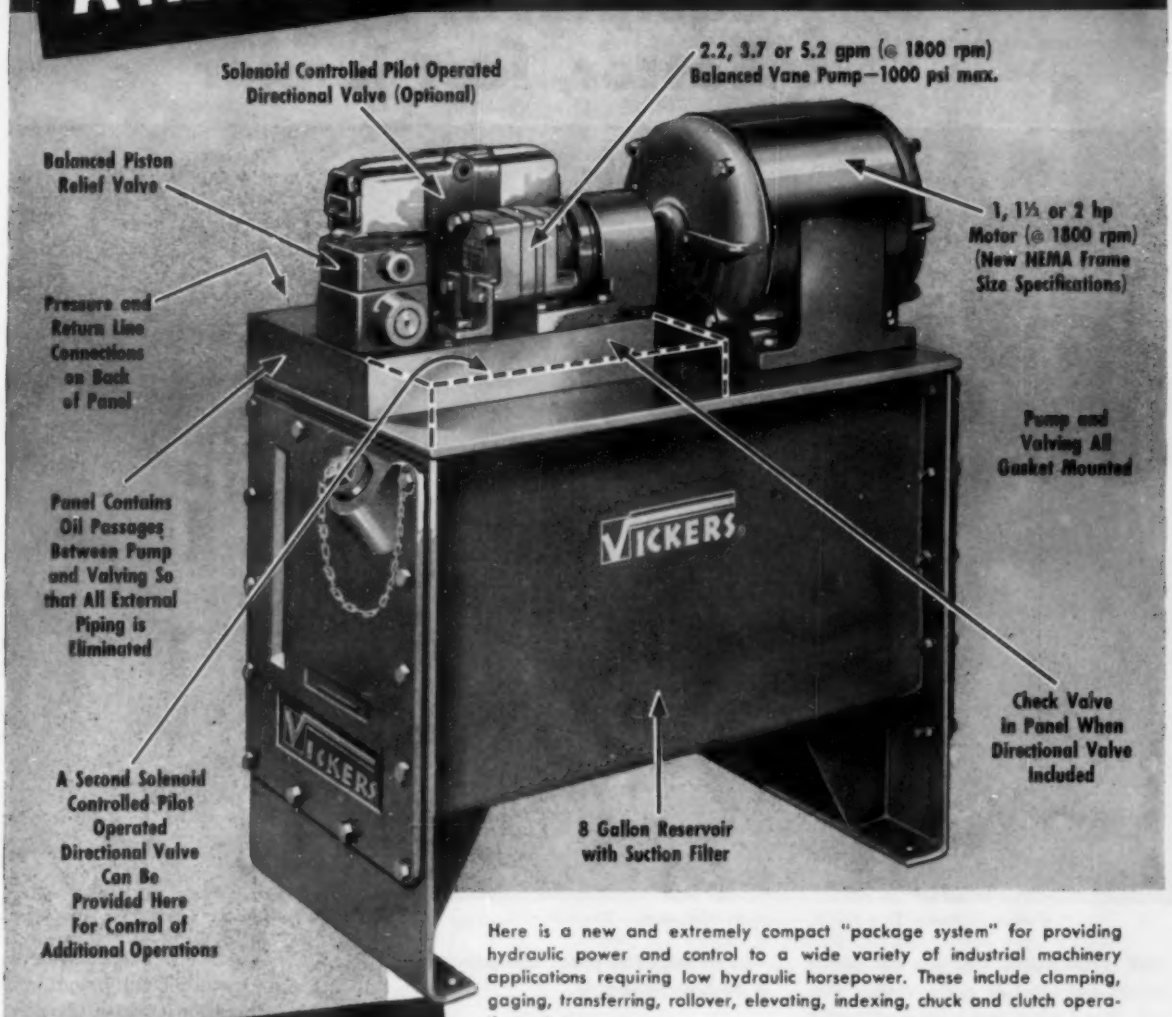
April 9-11: Fifth Welding Show of American Welding Society. Convention Hall, Philadelphia.

May 8-11: Spring Meeting of The Fluid Control Institute, Inc. Greenbriar Hotel, White Sulphur Springs, W. Va.

June 9-14: Third Annual Automation Seminar, Pennsylvania State University, University Park, Pa. For complete information and registration contact Chester Linsky, assistant professor of industrial engineering.

October 17-18: The 13th Annual Conference on Industrial Hydraulics. Hotel Sherman, Chicago, Illinois. Raymond D. Meade is Conference Secretary. ▼▼▼

A NEW IDEA . . . in hydraulic power and control systems


Solenoid Controlled Pilot Operated Directional Valve (Optional)
2.2, 3.7 or 5.2 gpm (@ 1800 rpm) Balanced Vane Pump—1000 psi max.
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A Second Solenoid Controlled Pilot Operated Directional Valve Can Be Provided Here For Control of Additional Operations
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Here is a new and extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

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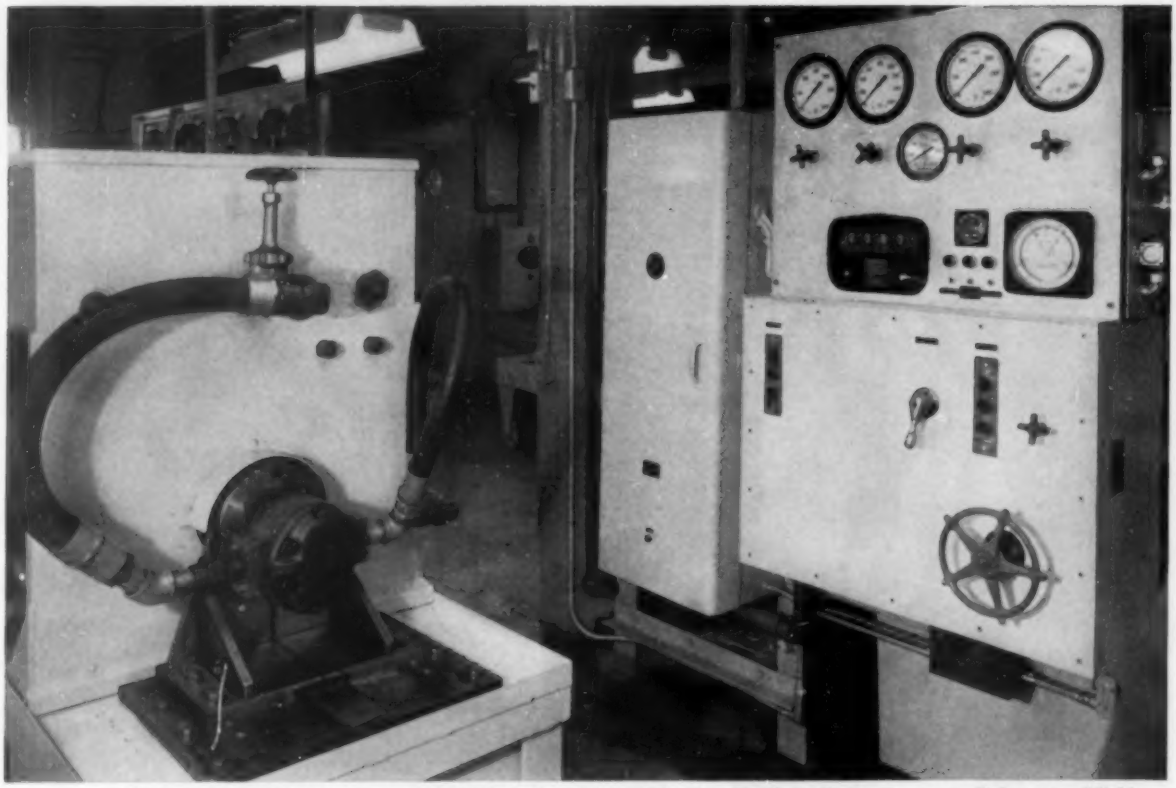
In Canada : Vickers-Sperry of Canada, Ltd., Toronto

*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

HOW to make hydraulic equipment run better, last longer



Hydraulic Pump Test Stand—courtesy Kalamazoo Division, The New York Air Brake Company, Kalamazoo, Michigan

THE HYDRAULIC OIL you use determines the kind of performance you get. Read what one operator (name on request) who uses *Texaco Regal Oil R&O* in an extrusion press has to say:

"No stoppages, no delays in production, no trouble whatsoever. Periodic checks show the oil to be in excellent condition, without a trace of sludge. The entire system stays clean, free from rust and foam —even with the press operating on a 24-hour schedule."

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TEXACO

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FOR ALL HYDRAULIC UNITS

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Designing a hydraulic elevator for a modern aircraft carrier is a problem in "specials". There are very few catalog items in this equipment which combines elements of hydraulic, mechanical, and electrical systems. Only a thorough knowledge of principles permits this kind of advanced design.

FIG. 1. THE U.S.S. FORRESTAL showing four elevators at the flight deck. Elevators are each powered by a horizontally mounted hydraulic cylinder acting through cables to the elevator platforms.

SERVO CONTROLLED AIRCRAFT ELEVATORS

. . . on the navy's large carriers

• By C. M. Mullis and L. R. Rissler

HYDRAULICALLY operated, servo controlled elevators have been designed to raise airplanes based on large aircraft carriers of the Forrestal class. Using two pressure compensated, axial piston pumps, and accumulators, the system has a servo controlled, 4-way valve which controls fluid to the main cylinder.

The elevators are installed so that aircraft may be moved from the hanger deck to the flight deck and down again. Based on experience from previous aircraft carriers, all elevators are of the deck edge type which has its hoistway on the outside of the ship's hull. The hoisting machinery is in the hull next to the platform structure.

The platform accommodates the largest and heaviest aircraft proposed for carrier service. It travels from the main deck to the flight deck and is guided by rails supported by the ship's structure. Four sets of rollers, two at each end of the platform run in channels. The channel rail guides the platform in a fixed path and withstands all the forces the platform may impose upon it, such as operating loads, wind, and sea forces.

Two sets of steel ropes, one at each end of the platform run to deflector sheaves under the flight deck and down through the main deck to a horizontal hydraulic cylinder in a compartment below the main deck. Hydraulic power to raise the platform is supplied to the cylinder from a tank accumulator containing oil

C. M. MULLIS, *Engineer*, L. R. RISSLER, *Engineering Section, Manager, Elevator Div., Westinghouse Electric Co., Jersey City, N.J.*

under high gas pressure. When the platform is lowered, oil is discharged into an exhaust tank which is under low gas pressure. The flow of oil to the cylinder is controlled by a special, balanced type valve. The valve movement is controlled by a control unit which is part of a servo system. An electric motor driving the servo unit establishes the running speed of the elevator as well as its acceleration and deceleration. A control on the main deck permits operating the control valve by hand through the valve servo system.

POWER SYSTEM

Oil pressure is produced in a closed hydraulic accumulator system, Figure 2. Two variable delivery pumps are each equipped with a compensator control to set the pumps to zero stroke when the pressure in the high pressure tank has reached the maximum pressure. As oil is used from the high pressure tank and the pressure drops, the compensator sets the pumps on stroke to pump oil from the low pressure tank to the high pressure tank. When the platform is lowered, oil is expelled from the hydraulic cylinder to the low pressure tank.

An auxiliary high pressure air tank adds air to the high pressure tank to reduce the pressure drop for a given amount of oil used. This reduces the number of pumping units required. A strainer is connected at the suction inlet of each pump to strain all oil entering the pump. One filter is provided for the entire system to filter a portion of the circulated oil. All leakage is drained to a sump tank, and sump pumps are provided to return this oil to the system. The sump pumps can also be used during an emergency to jack the platform to the flight deck by pumping directly into the hydraulic cylinder.

CONTROL VALVE

The speed of the elevator is determined by the rate at which the oil is permitted to enter or leave the cylinder. A balanced type piston valve controls this rate. The speed of the elevator is proportional to the total area of orifices uncovered by the valve piston. The rate at which these orifices are covered or uncovered determines the rate of

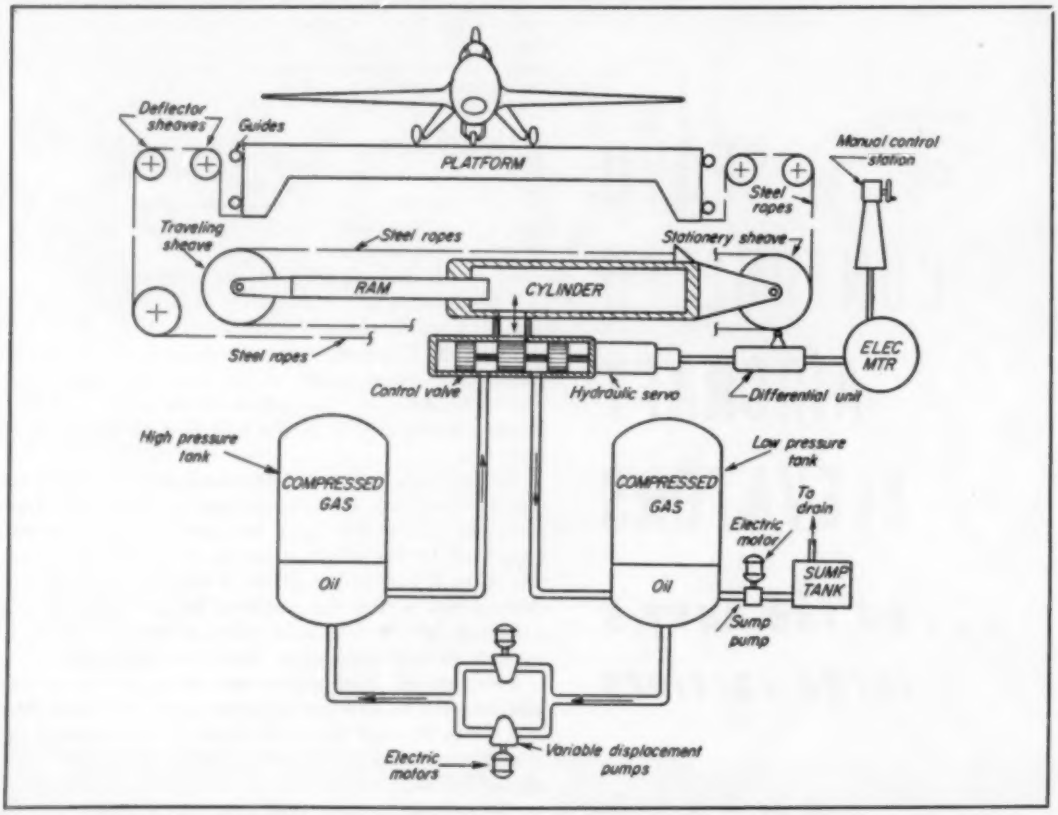


FIG. 2. ELEVATOR SYSTEM is powered by two pumps which deliver oil to high pressure tank. Valve which directs oil to or from cylinder is controlled by servo system. Servo output adjusts valve position, so that elevator speed is equal to electric motor speed. Manual control station permits rotating pilot motor by a handwheel providing manual control of elevator speed.

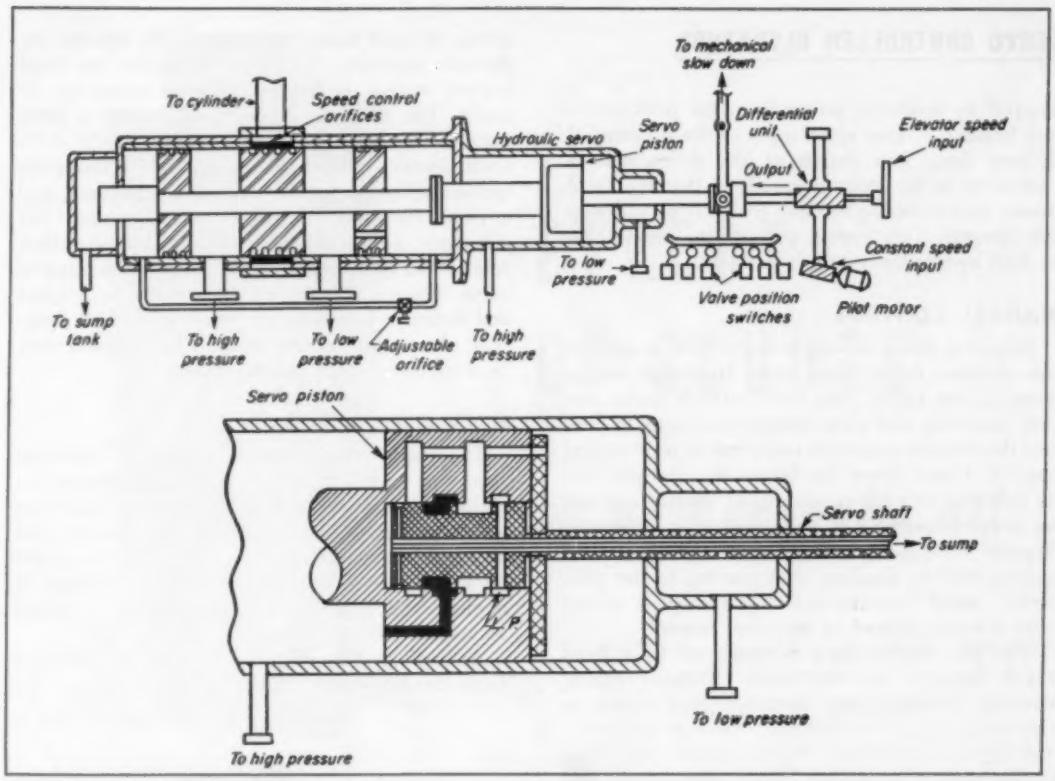


FIG. 3. VALVE SERVO SYSTEM controls speed, direction, and acceleration of elevators. Position of valve center piston determines speed and direction of elevator movement. Output of differential is connected to servo shaft which determines position of servo piston and control valve. Inputs to differential unit are pilot motor speed and elevator speed. Difference determines servo shaft speed.

acceleration or deceleration of the elevator.

The control valve, Figure 3 has outlets to the cylinder, the high pressure tank, and the low pressure tank. A three-piston element moves within the body. The center piston covers orifices at the cylinder outlet. The other two pistons provide a hydraulically balanced valve. The two end cavities are under pressure from the low pressure tank. The left center cavity is under pressure from the high pressure tank, and the right center cavity is under pressure from the low pressure tank. If the piston is moved to the right, the center piston uncovers the speed control orifices and permits oil from the high pressure tank to enter the cylinder raising the elevator. If the piston is moved to the left, the center piston uncovers the orifices so that oil passes from the cylinder to the low pressure tank lowering the elevator platform. Connecting the two end cavities eliminates hydraulic lock and provides a dampening effect.

SERVO SYSTEM

Because of its size, the valve is operated hydraulically by a servo system, Figure 3. If the servo shaft is moved to the left, high pressure oil is admitted to both sides of the servo piston. Because the left shaft has a larger diameter than the right shaft, a differential force is developed in a direction to move the servo piston and control valve piston to the left. If the servo shaft is moved to the right, the pressure in the right cavity drops to the low pressure valve, and a differential force to the right is developed moving the control valve piston to the right. If the servo shaft is stopped, the servo piston will move to a position to establish a pressure in the right cavity that will create balanced forces on the servo piston. The pressure drop across the portings maintains this condition.

The movement of the servo shaft is controlled by the linear output of a differential unit. The two inputs to the differential are the elevator speed and a constant speed, electric pilot motor. The difference between these two speeds determines the speed at which the servo shaft and control valve piston are moved. When the elevator is moving at the same speed as the pilot motor, the motion of the valve is zero—all other conditions being equal. The direction in which the pilot motor rotates establishes the direction the valve and the elevator move. Thus the elevator can be controlled by controlling the pilot motor. The elevator is

stopped by removing power from the pilot motor and braking it. One speed input to the differential is then zero. The output of the differential is equivalent to the elevator speed, so that the valve moves in a direction to close the orifices and stop the elevator. This system permits the elevator to be held hydraulically at any position.

MANUAL CONTROL

In case of power failure, it is desirable to operate the elevator for a short time from the energy stored in the tanks. Also it is desirable under certain operating and maintenance conditions to control the elevator manually independent of electrical control. Under these conditions the elevator can be operated very slowy with good control and can be stopped and held in any position in its travel. Manual control is accomplished with the hand control station, shafting, and gearing to the pilot motor which permits rotating the pilot motor with a crank instead of electrical power.

The pilot motor shaft is connected to a hand crank through an electrically operated clutch, shafting, gearing, and friction brake which is spring set and manually released. To operate the elevator manually, the hinged cover on the hand control station is rotated to give access to the crank. The rotation of the cover meshes a bevel gear on the hand crank to the gear on the drive shaft, opens the electrical switch, and releases the spring-applied brake through levers, linkages, and a cam. The open electrical switch ensures that automatic operation is nullified. Rotating the crank rotates the pilot motor and operates the control valve. The elevator travels up or down at a speed and direction proportional to the speed and direction of rotation of the crank. The elevator may be stopped by stopping the crank.

MAIN CYLINDER

The main cylinder is a horizontally mounted ram type unit with 1:2 roping over sheaves on the piston. Welded construction results in minimum weight and maximum reliability. The piston slides in bronze bushings in the cylinder and is guided by rollers which ride on the finished surfaces of a guide rail. The travel of the piston is limited by positive stops.

As indicated in Figure 2, cables are directed from dead-end hitches on the cylinder, over the

Concluded on page 86

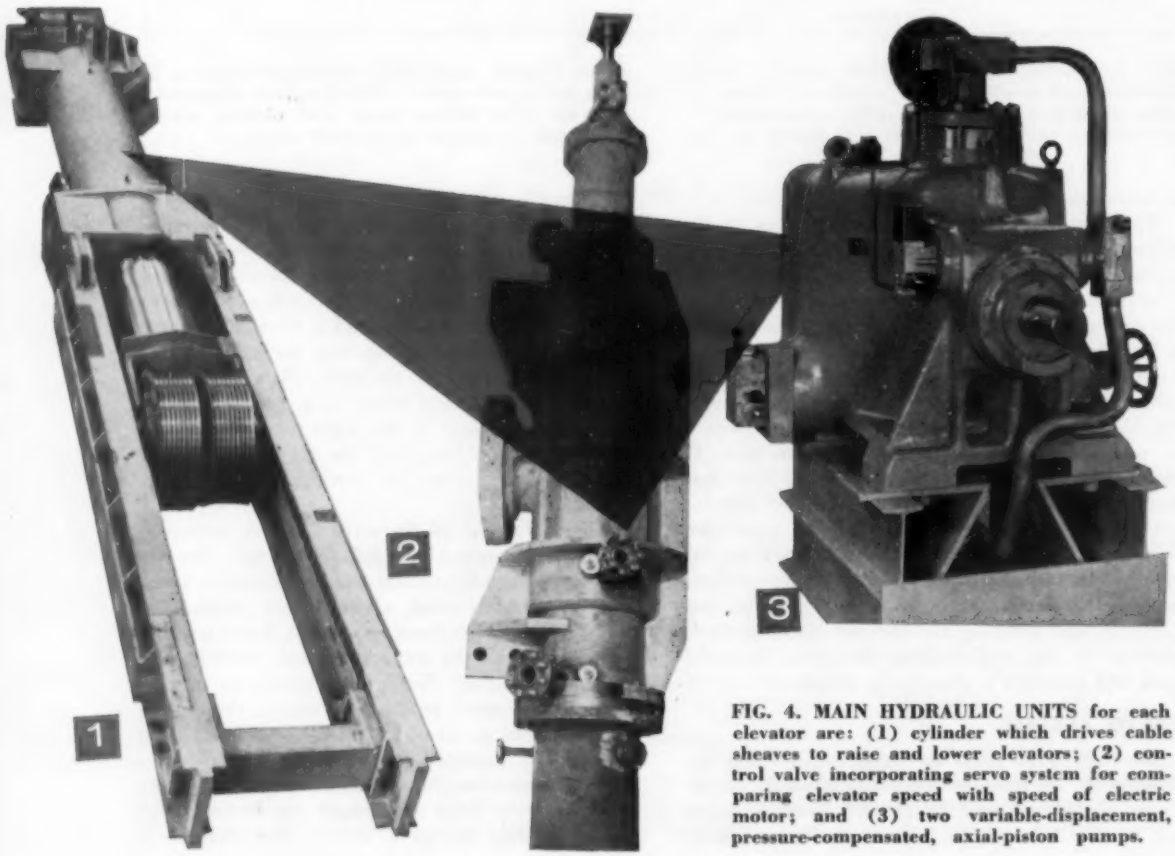


FIG. 4. MAIN HYDRAULIC UNITS for each elevator are: (1) cylinder which drives cable sheaves to raise and lower elevators; (2) control valve incorporating servo system for comparing elevator speed with speed of electric motor; and (3) two variable-displacement, pressure-compensated, axial-piston pumps.

CONTAMINANTS are removed by a wire screen filter located in the suction line to the hydraulic pump. Use of a hydraulic cleanout oil helps to bring contaminants to the filter.

EFFECT OF SLUDGE

...on hydraulic oil

It does pay good dividends to clean your hydraulic systems when you change oil. As little as one percent of sludge left in a system can cause over 100 percent increase in deterioration and cut the service life of the oil in half.

● By B. M. Dunham

JUST how clean must a hydraulic system be to get a maximum service life from new oil?

It may surprise many users of hydraulic fluids to learn that they have not been getting the service life they are entitled to; that a small percentage of sludge contaminants left in a system will contaminate fresh oil at a rate greatly in excess of normal use.

It is an established fact that most oil changes in industrial systems are required because of contamination rather than an excessive deterioration of the oil. Oil deterioration is primarily a function of oil quality, length of service and temperature of operation.

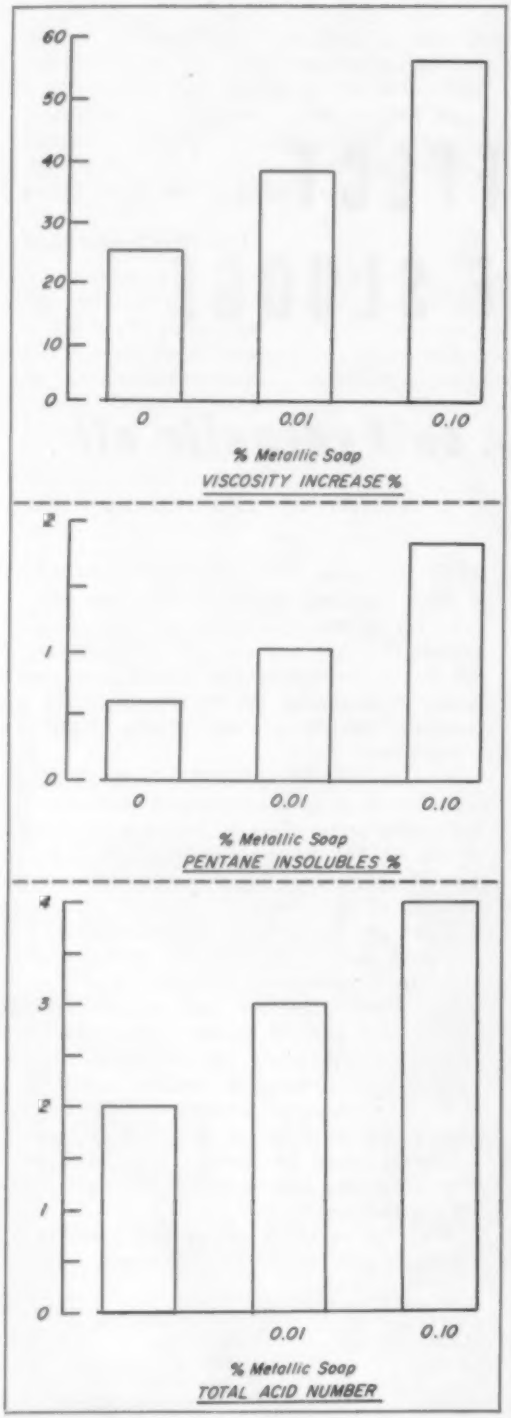
There are many types of contaminants, some of which may be removed by filters. However, some contaminants are deposited in the system and never reach the filter. Solid contaminants cause scoring and wear of moving parts, reducing efficiency of operation; orifices become plugged causing control valves to function erratically or to freeze. Acids cause corrosive wear. Water causes rusting and catalyzes oil deterioration. Leaks in a system caused by abrasive wear allow air to enter the system, causing erratic action and further oil deterioration.

A typical range of soluble and insoluble contaminants will include the following:

Dust	Water
Core sand	Gasket adhesives
Metal particles	Pipe dope
Grease	Mineral cutting oil
Lint	Soluble oil
Paint	Abrasives not cleaned off after manufacture
Packing and Gaskets	

B. M. DUNHAM, *Technical Consultant, Sun Oil Company, Philadelphia, Pa.*

EFFECT OF SLUDGE



THREE GRAPHS show the effect of metallic soap on factors which influence oil life. This data was gathered from an air oxidation test (325 F for 24 hours).

causing the commonly encountered deterioriation products of oil:

Gum	Soluble Ashpaltines
Varnish	Insoluble Asphaltines
Sludge (carbon)	Organic acids

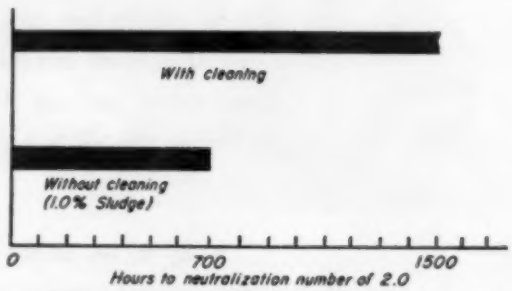
Data is available showing the catalytic effect of water and various metals on oil deterioration. Very little data, if any, has been made available on the catylytic effect of sludge on oil breakdown.

Laboratory tests show that traces of sludge in new oil decreases stability to a considerable degree and points to the need for properly cleansing an oil system so that fresh oil will not be "seeded" by oxidation products.

The catalytic effect of small amounts of metallic soaps contained in sludge on new oil terms of increase in viscosity, carbon (pentane insoluble material) and acid formation is indicated in accompanying charts. This graphic representation shows increase in new oil deterioration with additions of .01 and .10 percent metallic soaps. Based upon analysis of a wide variety of used oil samples, it can be safely assumed that if one percent sludge remains in a circulating oil system, it contains at least .10 percent metallic soaps. The actual reduction in service life in hours between a new oxidation inhibited type turbine quality oil (first quality hydraulic oil) put into a clean system and the same oil put into a system contaminated with one percent sludge is shown in the bar chart below.

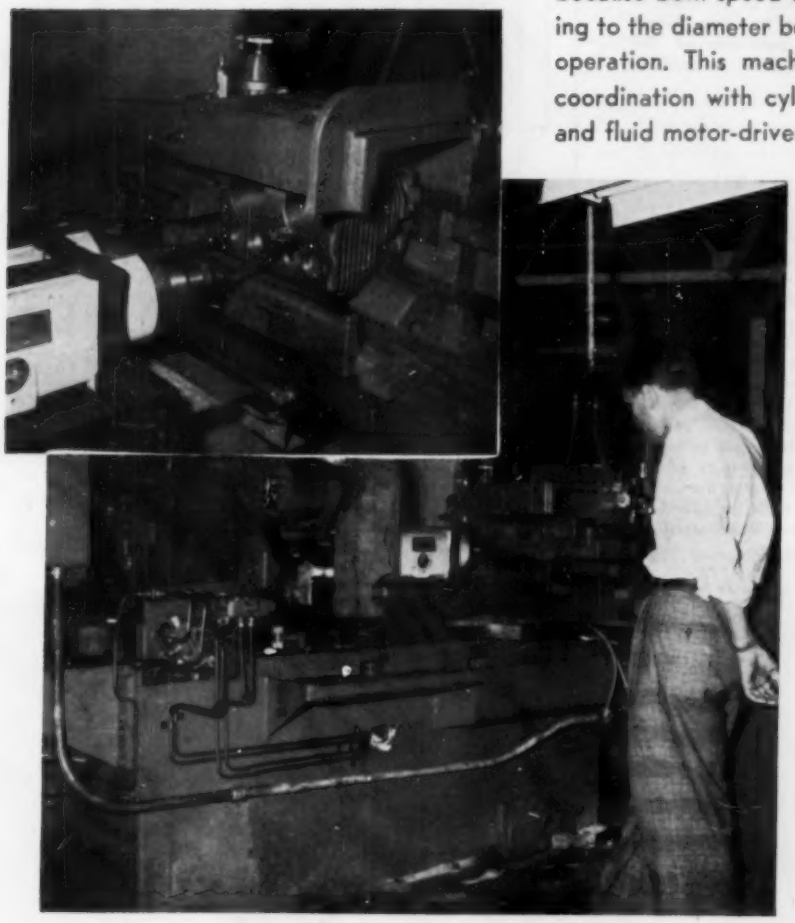
Oil suppliers have developed and marketed types of mineral oils which act as hydraulic system cleaners and at the same time function as hydraulic oils. They are available in viscosity ranges specified by hydraulic pump manufacturers. These oils may also be used as operating oils to keep systems clean by carrying contaminants of all types to the filter for continuous removal.

To fail to keep a hydraulic system clean is costly. In addition to doubling the cost of the oil, it increases service cost and reduces efficiency of pumps and valves by the acceleration of deterioration of the oil. ▼▼▼



EFFECT of 1% sludge left in a system when the hydraulic oil is changed is shown in this test result. Service life of oil in a clean system is greater than 1500 hours. In a system where 1% of sludge remained, oil service life was reduced considerably when measured by increased neutralization number.

Coordination between spindle speeds and feeds is often a machine tool requirement because both speed and feed vary according to the diameter being machined and the operation. This machine accomplishes this coordination with cylinder-driven tool slide and fluid motor-driven spindles.



TO OBTAIN completely automatic operation in boring and reaming engine blocks, this machine was modified from a standard boring machine. Blocks are manually loaded on tracks. They then index to the proper position for boring and reaming, as the tools move in at the proper feeds and speeds.

Control of...

SPINDLE SPEED and TOOL FEED

• By Harvey Prill

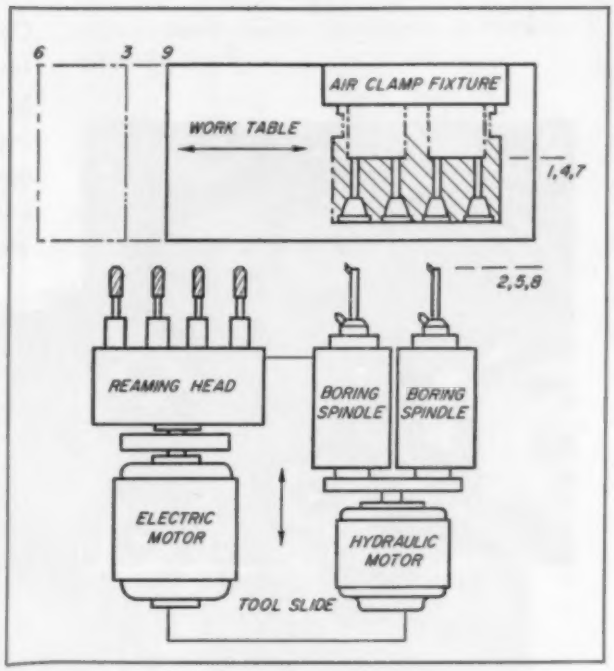
ENGINE blocks are turned out by the thousands at Wisconsin Motor Co., so automatic machines—whether standard or special—are necessary. One of the operations on 2 and 4 cylinder engine blocks is to bore, counterbore, and ream four valve holes. To do this job, a special machine was developed from a standard boring machine. The machine bores two holes at a time with the work

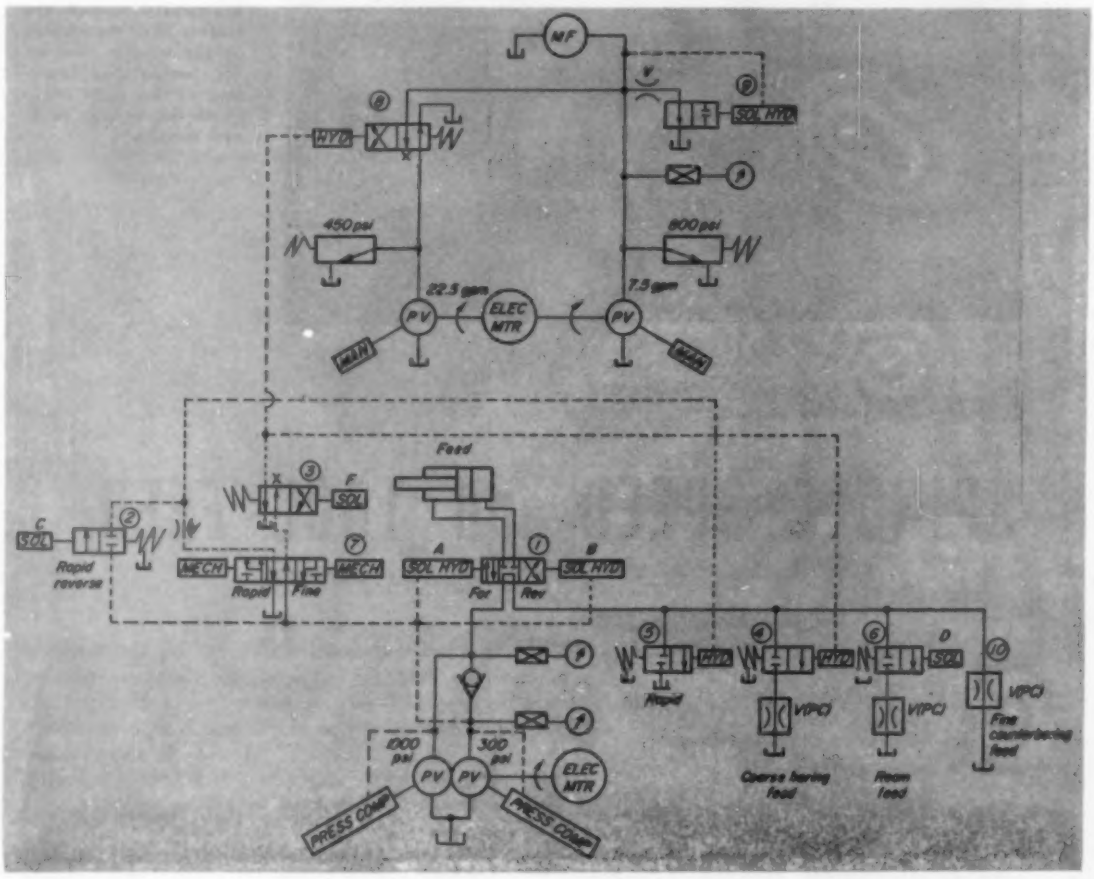
HARVEY PRILL, *Chief Tool Engineer, Wisconsin Motor Co., Milwaukee Wisconsin.*

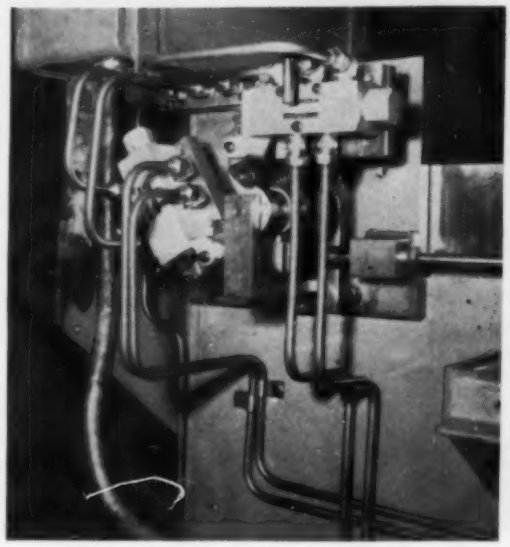
SPEED CONTROL

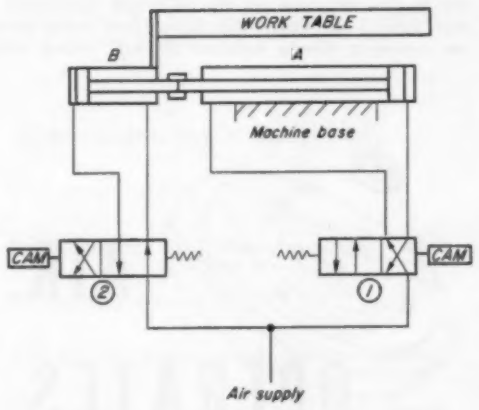
TOOL SLIDE and work table move perpendicular to each other. Sequence of motions is indicated by numbers at each position. Limit switches actuated at various positions of the slides control the solenoid valves to initiate machine sequences.

RATE OF FEED CYLINDER driving the tool slide is determined by actuation of valve, 4, 5, or 6, or none of these. Valve 5 connects feed cylinder to tank for rapid approach. Valves 4 and 6 connect cylinder to tank through flow control valves to provide coarse boring feed and reaming feed. When none of these valves is open, flow is through flow control valve 10 for fine feed for counter-boring. Valve 7 is a rotary valve actuated by the tool slide. When valve 3 is actuated and valve 7 is in the rapid or coarse position, valve 8 connects the output of the 22.5-gpm pump to the fluid motor for high-speed boring. Valve 9 controls a bleed-off circuit to the fluid motor and is deactuated for slow speed reaming and idling.









AIR VALVES CONTROL operation of work table. Opposing cylinders have piston rods connected. Cylinder A, with a stroke of 13 3/4 inches, is mounted on stationary machine frame. Cylinder B, with a stroke of 2 1/2 inches, is mounted on movable work table. Valve 1 is actuated and valve 2 is deactuated when table is in initial position. At the first return stroke of tool slide, valve 2 is actuated admitting air to the head end of cylinder B. Because cylinder A is held in the retracted position and cylinder B piston is filled, cylinder B moves the table to the left for boring the second pair of holes. At the second return of the tool slide, valve 1 is deactuated extending cylinder A and moving the table to the left for reaming the four holes. At the third return of the tool slide, the cam is rotated so that valve 1 is actuated and valve 2 is deactuated and the table moves to the right to the initial position for unloading and re-loading.

table moving perpendicular to the tool slide for indexing. The machine then finish reams all four holes at once in its finishing position.

The work table is driven by two opposing air cylinders which have their rod ends joined together. One of these cylinders is mounted on the machine bed, and the other cylinder is mounted on the work table. This arrangement permits three indexing positions. Operation of the cylinders is controlled by two cam-operated valves which are actuated by a

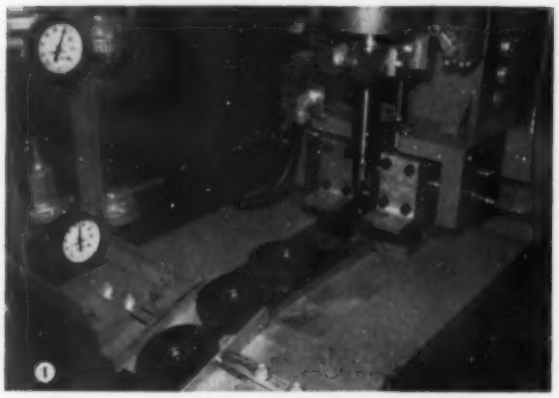
"We started with a tool bed, mounted boring heads, arranged an automatic transfer mechanism, and designed air, oil and electrical circuits for proper machine motions and spindle speeds."

ratchet-driven cam rotated by the tool slide on its return stroke. In the first and second positions, the tool slide feed rate is controlled by a rotary valve actuated by a dog on the slide. The valve can also be operated manually for set-up.

The machine cycle is as follows:

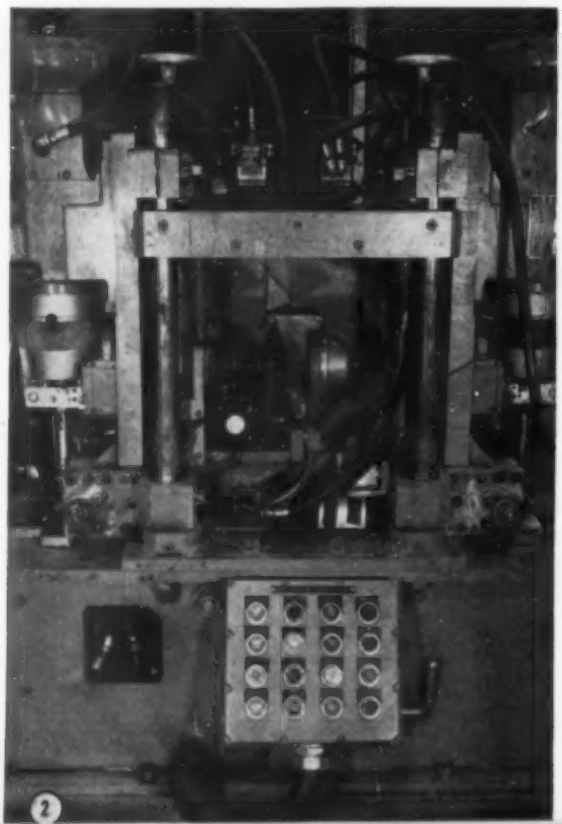
1. With work table in initial position, tool slide moves forward at rapid speed until in boring positions.
2. Boring tools move in at high speed and coarse feed until near end of hole.
3. Boring tools move in at fine feed, slow speed for counterboring.
4. Rapid reverse of tool slide. Work table indexes to second position when tool slide is fully back.
5. First four steps are repeated. Work table indexes to third position for reaming.
6. Tool slide moves forward at rapid feed. Reamers rotate at medium speed driven by separate electric motor.
7. When reamers work, tool slide moves at slow reaming feed.
8. Tool slide reverses. Work table indexes back to initial position.

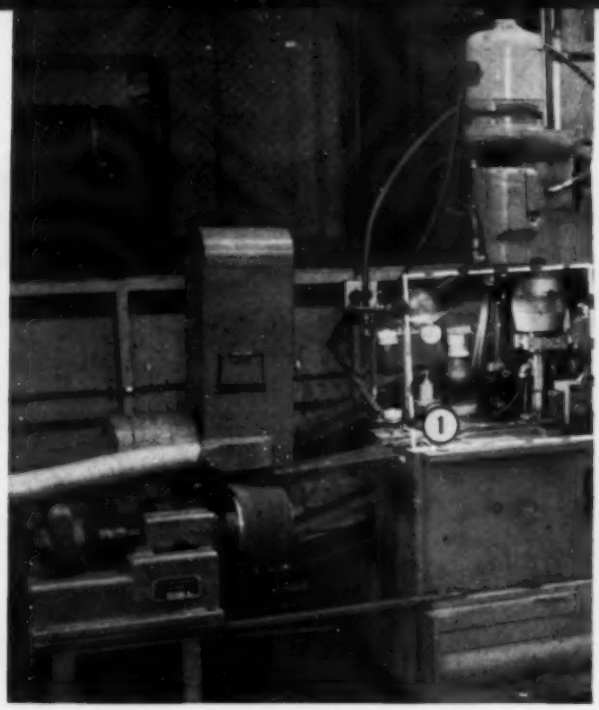
Feed rates of the tool slide are controlled by one of several meter-out circuits selected by actuation of pilot-operated and solenoid-operated valves. The vane type motor which drives the boring spindles has a displacement of 3.47 cu in per rev and develops a torque of 55.1 lb-in per 100 psi. Two variable-volume pumps with positive volume control driven by a 7½-hp motor supply the fluid motor. These pumps have capacities of 7½-gpm and 22½-gpm. With their combined output connected to the fluid motor, the motor has a speed of approximately 2000 rpm. This is infinitely variable in either the high or low speed range by adjusting the output of of the variable volume pumps. ▼▼▼



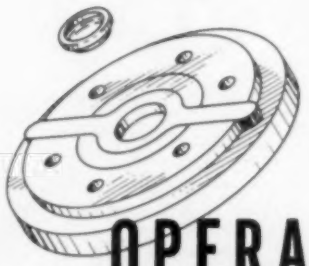
SWAGING OPERATION is about to begin with air-powered chucks holding work in position. Circular depression is achieved by rolling a carbide tool over the button at 150 rpm with 600-lb force. Limit switches are actuated by swaging head and chuck mechanism to interlock these operations with others in the cycle.

BUTTON IS DISPENSED from the hopper by an air cylinder. Electrical control indexes the lining to the next position when the button drops into place. Hopper will not release button unless lining is in position. Manual-operation pushbutton station permits performing each operation individually, so that the machine can be set up for various size linings.





COUNTERBORING THE CENTER HOLE of a brake lining, placing a button in this hole, and swaging the button in place are the principal operations of this special machine. The linings are hand loaded on conveyor blocks indexed by two chains which



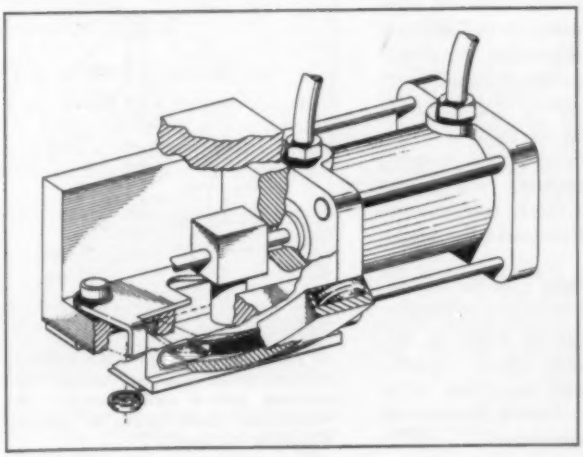
AIR OPERATES TRANSFER MACHINE

• By F. C. Rongone

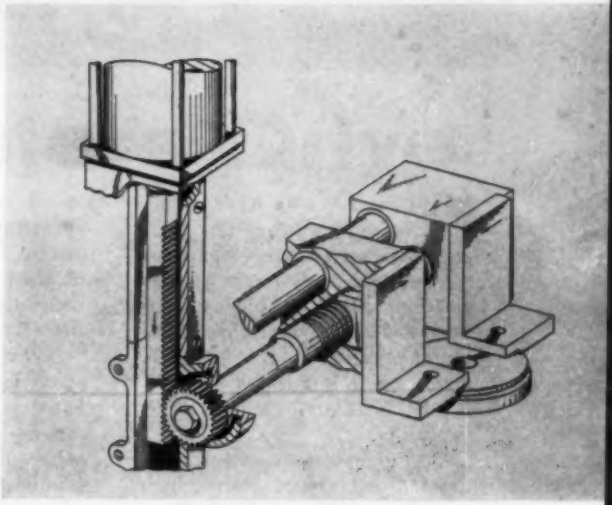
Tool Design Section, Wheel & Brake Div., Goodyear Aircraft Corp., Akron, Ohio

are powered by a pneumatic index table. The linings are chucked at the counterboring and swaging stations. The parts are de-burred by the sander at left. One operator can produce approximately 5200 finished parts in one 8-hour shift.

Standard pneumatic equipment was used in the design of this transfer machine. An index table drives the conveyor, and solenoid-operated valves control the chucks, dispenser, and drill heads.



THREE-FLUTED, CARBIDE TIP COUNTERBORE is electrically rotated in air-oil drill head. This operation removes mold flash from the brake linings. Air-oil feed gives positive limitation of pressure and hence reliable overload protection.



CHUCKS ARE OPERATED BY AIR CYLINDER through rack and pinion driving a screw. This arrangement gives a compact design with a high force increase. Operation of the chuck jaws is electrically interlocked with the counterboring and swaging heads, so that the heads will not feed down unless the chuck jaws are clamping parts in position. The correct position of swaging is repeated within .003 inch.

BUTTON DISPENSING UNIT is actuated by air cylinder which is electrically controlled to operate when brake lining is in position to accept button. Air cylinders operating counterboring and swaging heads, chucks, indexing, and dispenser are controlled by 12-volt solenoid valves.

CYLINDER and gear "team" in action on a road maintenance assignment.

Faster moldboard handling means more work done in less time. This combination of cylinder and sector gear swings the blade from ditch cut to high bank in less than a minute.

CYLINDER AND GEAR "TEAM"

...increase grader efficiency

MECHANICS and hydraulics have been teamed on this grader to obtain maximum torque and the required control arm angular rotation, using the simplest components. The basic idea has potential application to any hydraulic action where ram length has been a limiting factor on efficiency or versatility.

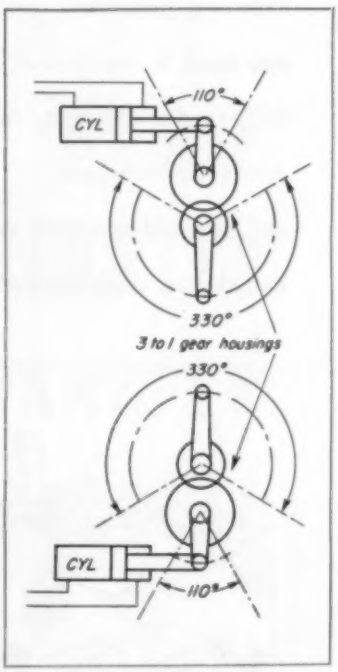
On this unit the mechanical-hydraulic gear system powers both the lift and the lateral shift of the blade. Gears provide a 3 to 1 multiplication of the movement accomplished by the hydraulic ram action. The hydraulic power provides easier operation and the gears convert the thrust to mechanical turning power.

The operator controls all blade movements from the cab of the grader, working through the full range of the controls without making manual adjustments. As the blade is handled efficiently, more work can be done in less time. The moldboard may be swung from a ditch cut to a high bank cut—a 90 degree swing—in less than a minute. Movement is continuous. Indexing and re-indexing required on other systems have been eliminated by the cylinder and gear team.

Several designs were considered and tried to secure the desired continuous movement without manual adjustments by the operator. The hydraulic cylinder and sector gear combination was selected for simplicity in bearings and closure, minimum space required and economy in component cost. Also, simplicity of design and slow movement of parts assures lower maintenance requirements.

Another cylinder and gear "team" is the circle reverse mechanism which revolves the blade 360 degrees.

Other hydraulic applications on the new grader include a hydraulic ram for raising or lowering the scarifier, a ram which "leans" the front wheels to offset sidethrust, and hydraulic brakes on the front tandem drive. ▼▼▼



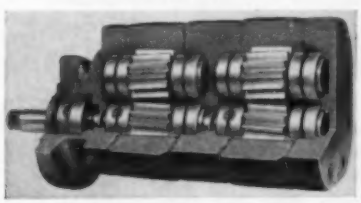
CYLINDERS impart the thrust. Sector gears convert thrust into turning power and multiply the movement three times to furnish required rotation.

Hydraulic Motors Drive Crawler At Two Speeds

Two "Commercial" oil hydraulic tandem motors propel the crawlers of this Gradall. In fact you might say that there are really four motors as each tandem motor consists of two single motors. Here is how they operate to give the Multi-Purpose Gradall low and high speed ranges.

single or combined output

Two single motors are mounted with one common drive shaft. When fluid power from the pump ource is directed by simple valving into just one of the single motors, the shaft rotates in the high speed range desired for propelling the crawlers where the going is on good level terrain. The other single motor on the same shaft receives no input and therefore idles at motor speed. When conditions are otherwise and low speed is required, it is accomplished by simply valving half of the fluid into each of the single motors. Because the volume feeding into each is less, the speed is reduced. Both tandem motors can be stopped or operated in either direction to give forward or backward travel to the crawlers.



Look at the heavy duty bearings which absorb the shaft and gear loadings. Perfect alignment of the matched helical gears results in more efficient, smoother, quieter and longer life operation.

50 h.p. output

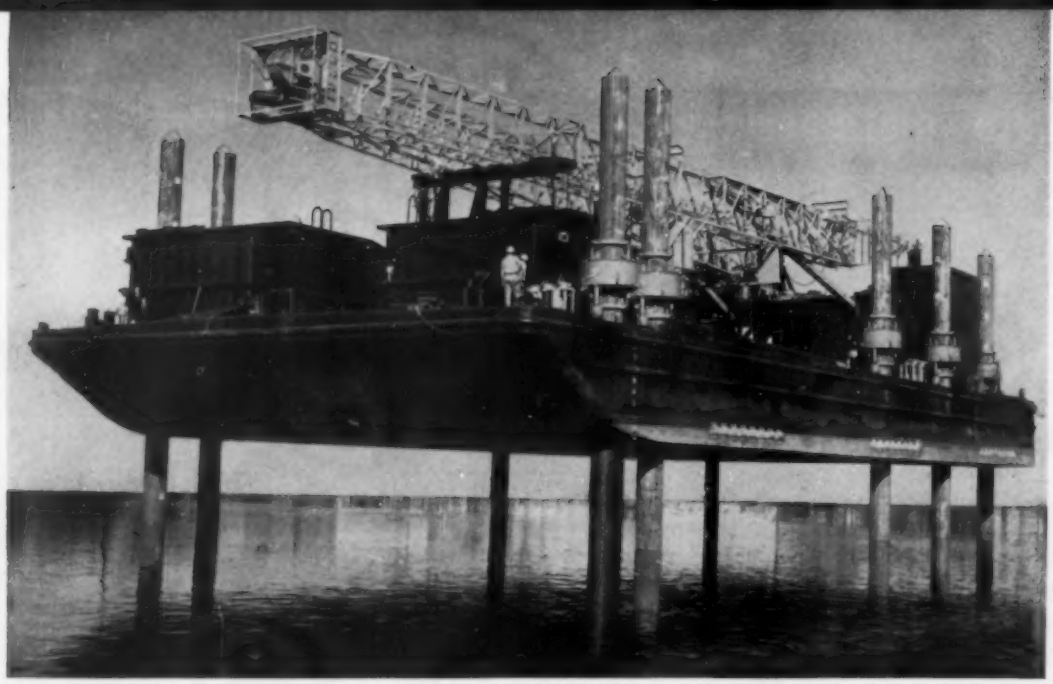
As an example, an "H" Series single shaft tandem motor receiving an input of about 15 gpm at 1200 psi would rotate at 1200 rpm when the entire input was directed to only one of the two single motors When this input is split between both motors, their speed would drop to 600 rpm. The example is based on two single motors mounted in tandem on a common shaft with each motor having gears of 1 inch face. Motors with larger gear widths are available to develop a rated output up to 50 h.p.

important advantages

All of this is accomplished without shifting of gears. Power takeoffs, clutches and gear transmissions are eliminated. Here is another proven application where fluid power is piped around corners. It is successful because space is conserved and high initial cost mechanical drives with their constant maintenance problem are eliminated. Write to Dept. A-6, The Commercial Shearing and Stamping Company, Youngstown, Ohio,

COMMERCIAL
shearing and stamping

Circle 26 on Reader Service Card

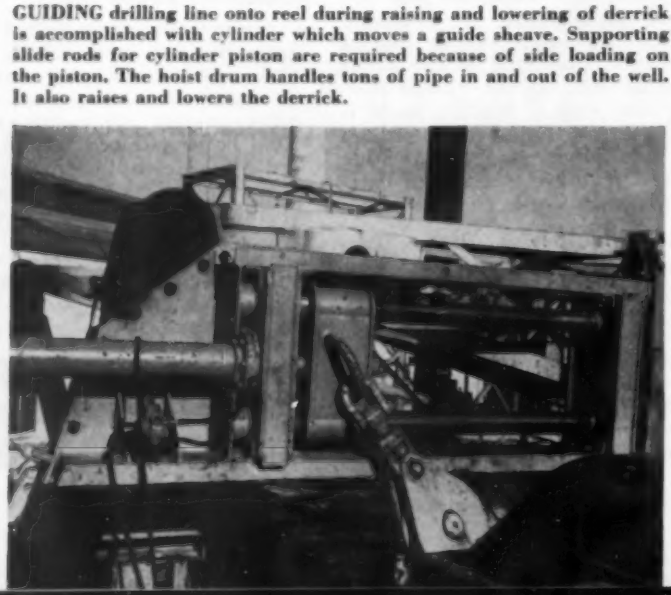


TEN HYDRAULICALLY operated spuds raise barge out of water for drilling. Spuds are driven by hydraulic jacks which actuate slip bowls encircling each of the 60-ft spuds. Separate controls allow positioning of the slip bowls one by one. When all have new grips, 4-ft stroke jacks operated in unison, lower or retract the spuds.

OIL POWER FOR OFF-SHORE WELL DRILLING

• By Robert O. Frederick

GUIDING drilling line onto reel during raising and lowering of derrick is accomplished with cylinder which moves a guide sheave. Supporting slide rods for cylinder piston are required because of side loading on the piston. The hoist drum handles tons of pipe in and out of the well. It also raises and lowers the derrick.

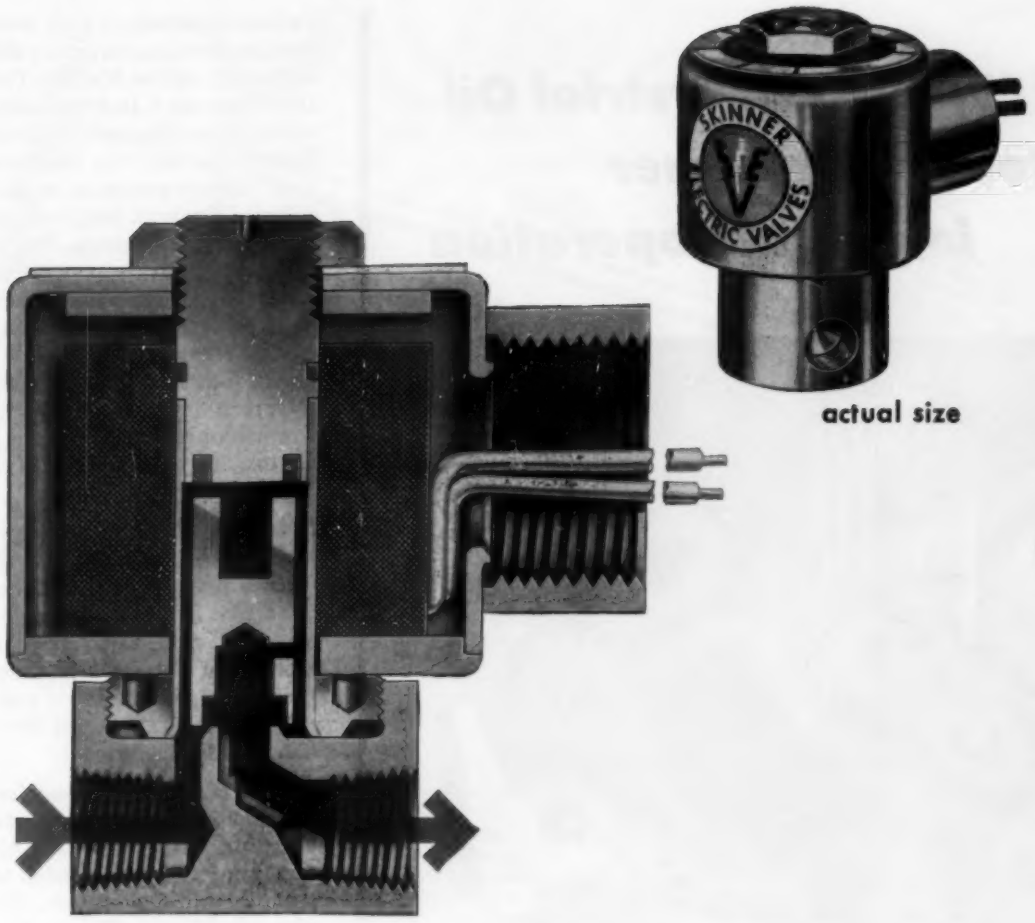


TWO vital operations are performed hydraulically on a barge designed to reduce production costs of oil well drilling at Venezuela's Lake Maracaibo. Use of this barge eliminates the need for large expensive drilling platforms.

Oil power is used to ram the ten, 60 foot long legs of the barge deep into the lake floor to lift it out of the water.

Unusual problems were encountered when the derrick was designed to be either raised for drilling or lowered for moving from one location to another. While the derrick is erect, the drilling line runs directly from the special sheave at the top to the hoist drum. However, while the mast is being raised or lowered, the line could not be reeled evenly because the angle of approach is constantly changing with the derrick's position.

To solve this reeling problem a manually controlled level wind was devised. When the mast is being raised or lowered, a guide sheave moves back and forth on a hydraulic ram in front of the hoist drum. ▼▼▼



actual size

New C-series solenoid valve offers recognized "Skinner Quality" at low cost

This is a faithful reproduction—in miniature—of the time-tested, 2-way, normally closed Skinner V5 except that the body is made of brass.

This new, compact Skinner valve weighs only 12 ounces, yet it's rugged enough to last millions of cycles on most applications.

This new valve has orifices from 5/32" to 7/64", with pressures ranging from 60 to 130 psi. Pipe size is 1/8" NPT. It is a packless, direct-acting valve with only two moving parts. And it's absolutely bubbletight—even on vacuum. This C-Series Skinner valve is fail-proof, too—a built-in spring return assures positive closing; thus it can be mounted in any position and is ideal for direct-line mounting.

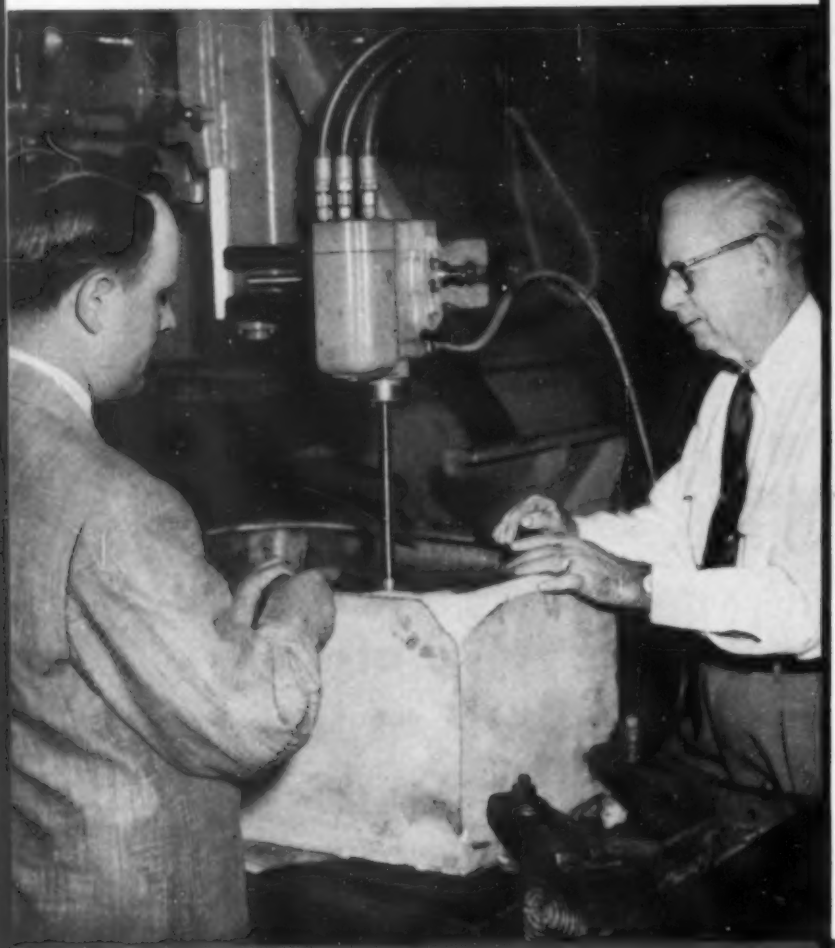
You'll find this new valve, with its recognized "Skinner Quality," the perfect low-cost answer to a wide range of flow control problems. It works efficiently with air, water, oils, gasoline and many other media. Typical applications include: automotive fuel systems, welding equipment, vending machines, lubricating devices, spraying equipment, air horns, water softeners, humidifiers and instrumentation.

Our Bulletin D11.1 contains complete information on this valve—flow curves, optional features, dimensions, electrical data, etc. We will be happy to send you a copy on request.

SKINNER ELECTRIC VALVES

SKINNER ELECTRIC VALVE DIVISION
NEW BRITAIN CONNECTICUT
THE SKINNER CHUCK COMPANY

STANOIL *Industrial Oil*
tough performer in delicate operation



A. T. Wallace (right), President of Wallace Tool and Die Company, and Standard Oil lubrication specialist, H. A. Peterson, check sensitivity of new Cincinnati Hydro-Tel Milling Machine which uses STANOIL as hydraulic medium. Howard Peterson has been providing technical service to customers since joining Standard Oil. He is a graduate of General Motors Institute. Howard's customers find this experience pays off for them.

Delicate operations with metal requiring almost a surgeon's skill are every day stuff to Wallace Tool and Die Company, Indianapolis. Recently, they purchased a Cincinnati Hydro-Tel Milling Machine for their highest precision work. They selected STANOIL Industrial Oil for the hydraulic medium. The reason for choosing STANOIL: they wanted a hydraulic fluid that could deliver high performance. They wanted a clean hydraulic system, free of deposits that might clog filters and interrupt operations. They wanted smooth operation without pump chatter and without foam. They got these with STANOIL.

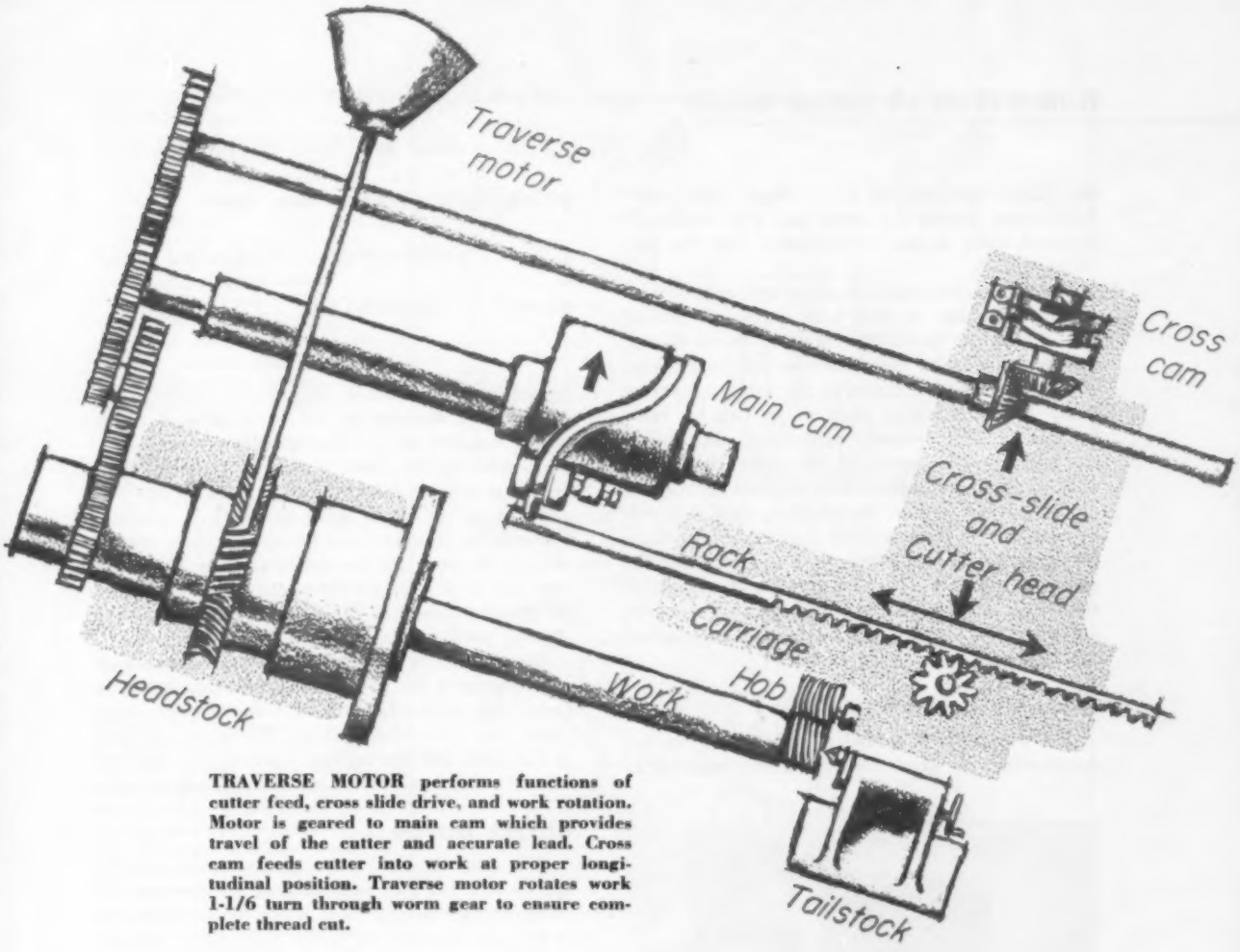
How did Wallace Tool and Die come to choose STANOIL? The answer is not hard to find. They had used STANOIL for hydraulic systems throughout their plant for many years. It has given them the results they wanted so it was natural to pick STANOIL for their new Cincinnati machine.

With STANOIL the machine performs the delicate operation of contour tracing with only 3½ ounces of pressure needed to control the milling cutters. STANOIL gives them smooth, steady, uninterrupted performance.

STANOIL can serve you. In the Midwest a lubrication specialist at your nearby Standard Oil office will be glad to show you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY (Indiana)



TRAVERSE MOTOR performs functions of cutter feed, cross slide drive, and work rotation. Motor is geared to main cam which provides travel of the cutter and accurate lead. Cross cam feeds cutter into work at proper longitudinal position. Traverse motor rotates work 1-1/6 turn through worm gear to ensure complete thread cut.

HOW FLUID MOTORS ARE USED ON A THREAD MILLER

• By L. F. Chaffee

TO obtain the advantages of fluid power—quick, stepless speed—control-engineers at Hanson-Whitney Co. have designed their thread milling machine to use two fluid motors. One of these motors rotates a main cam which transfers the rotary motion into transverse motion for the cutter head. Speed of the motor determines cutter feed. A second cam geared to this fluid motor drives the cutter cross slide feeding the cutter into the work. The fluid motor also rotates the work 1-1/6 revolution while the threads are being cut, assuring a complete thread cut and cleaning up that part of the thread which was not cut to full depth while

L. F. CHAFFEE, *Chief Engineer, Hanson-Whitney Co., Hartford, Conn.*

the cutter was feeding in to depth. The other fluid motor rotates the cutter and a hydraulically operated collet is also incorporated into the machine.

The main advantage of using hydraulic power on this machine is that both cutter speed and rate of feed can be exactly obtained. Speed change is now much faster than with the previous design which required gear changing. By using a separate pump for each motor, each pump can be rated for the job it is normally expected to do. During the rapid traverse parts of the cycle, the output of both pumps is combined to produce high speed of the traverse motor. In addition, this motor is hydraulically shifted to small displacement position for high speed during this part of the cycle. Because the pump unit which supplies the cutter is connected to drive the feed during rapid traverse, the cutter is stopped during loading and unloading and this provides a safety feature.

MACHINE OPERATION

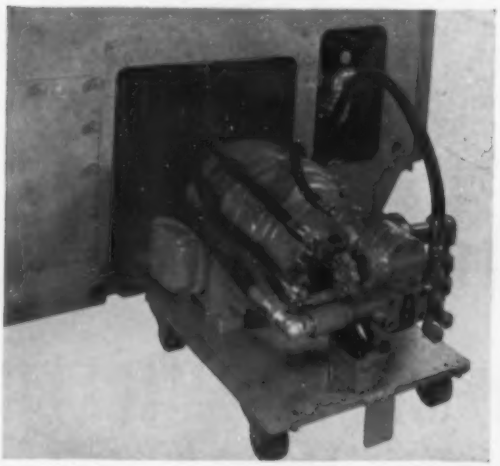
The workpiece is loaded manually into the hydraulically operated collet and the machine is started in rapid traverse. The spindle which is not yet rotating approaches the work until it is in proper relation to it. The spindle traverse then slows down to the preset work feed and the cutter begins to rotate. Next the cross head brings the cutter in to full depth while the work is rotating. The cutting continues until the work has rotated enough to clean up the entire thread. The cross feed cam then pulls the cutter out of the work and the machine goes into rapid traverse to its original starting position.

The machine is intended for thread pitches which are too coarse for practical die cutting, and it is faster and more efficient than using a single-point cutter in a conventional lathe. The maximum lead is 1/5 inch, and the milling machine cuts internal as well as external right-hand or left-hand threads.

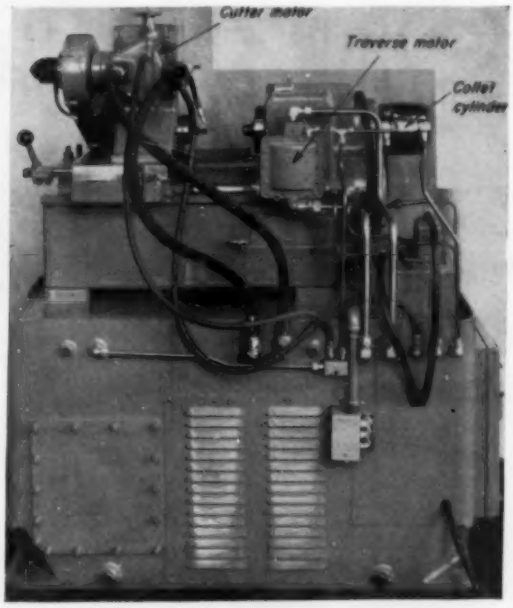
The use of fluid motors for spindle drive and feed on this machine points to many machine tool applications where quick, stepless speed control is required.

CUTTER MOTOR

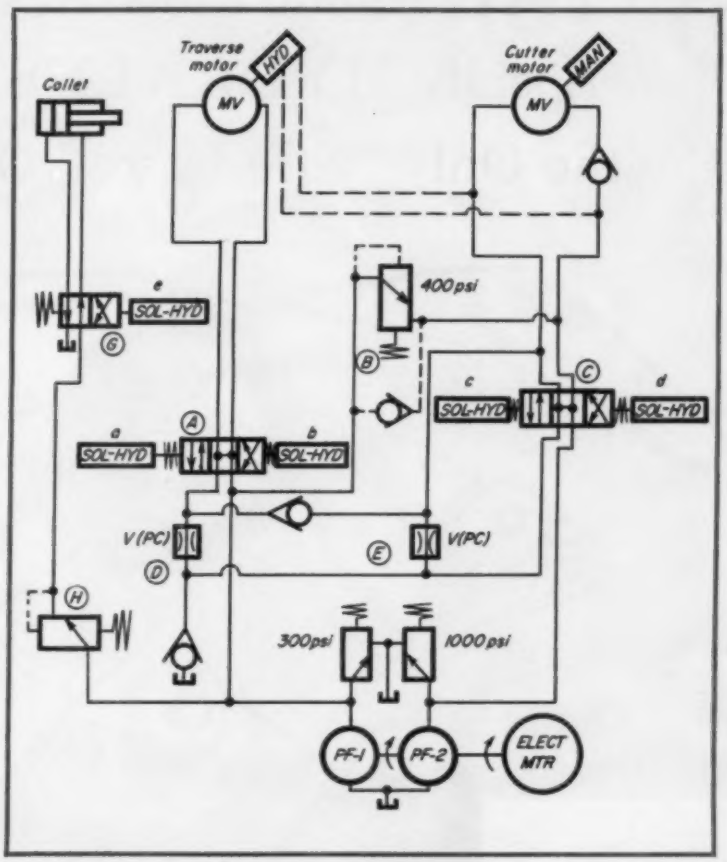
The cutter motor rotates the cutter at variable speeds to 3000 rpm indicated on an electrical tachometer calibrated in rpm. A variable displacement motor was selected to drive the cutter, because



DOUBLE PUMP and drive motor are mounted on roll-out platform in machine base. Small capacity unit supplies traverse motor. Large capacity unit supplies cutter motor during milling operation and traverse motor during rapid traverse.



REAR VIEW of thread milling machine showing cutter motor which rotates cutter, and traverse motor which provides cutter rapid traverse and feed and also rotates work piece. Cutter motor speed is controlled by handwheel and bleed-off circuit. Traverse motor speed is controlled by hydraulic actuator and meterout circuit.



THREE SOLENOID-CONTROLLED, pilot-operated valves control collet cylinder, and fluid motors. During loading both pump units are unloaded through valves *A* and *C*. Check valves in return line maintain 65-psi pressure for operation of collet cylinder. Actuating solenoids *a* and *c* to start rapid traverse directs fluid from pump 1 to traverse motor. Pump 2 delivers against check valve in line to cutter motor. Resulting pressure in this line actuates hydraulic control of traverse motor shifting motor to minimum displacement for high speed. Fluid from pump 2 is also directed through check of valve *B* to join with pump 1 output to traverse motor. At end of rapid traverse, solenoid *d* is actuated directing pump 2 output to cutter motor. Pressure at cutter motor input actuates traverse motor control shifting motor to maximum displacement for slow feed set by valve *D* which is connected in a meter-out circuit with the traverse motor. Check valve between flow control valves *D* and *E* is held closed by difference in pressure on cutter motor and traverse motor. Valve *E* is connected in a bleed-off circuit to control speed of cutter motor. When valve *C* is shifted to start feed sequence, surge which develops in line to traverse motor is relieved by valve *B* which is set at 400 psi. Collet cylinder is controlled by valve *G* which has single-solenoid, spring-loaded control. Spring holds valve in position for collet to be closed. Thus a loss of electrical power does not affect collet during rotation of work. For certain types of threads, solenoid *b* is actuated with the gearing reversed, providing feed in the opposite direction.

normal loads make a constant horsepower output at the cutter desirable. Large cutters require a high torque and must be driven at slow speeds to maintain good cutter life. Small cutters require less torque and can be driven faster for an equivalent peripheral speed. Where the material permits the cutter to be driven at high speed, low cutting torque is required; and for materials requiring higher cutting torque the cutter must be driven slower to obtain good life.

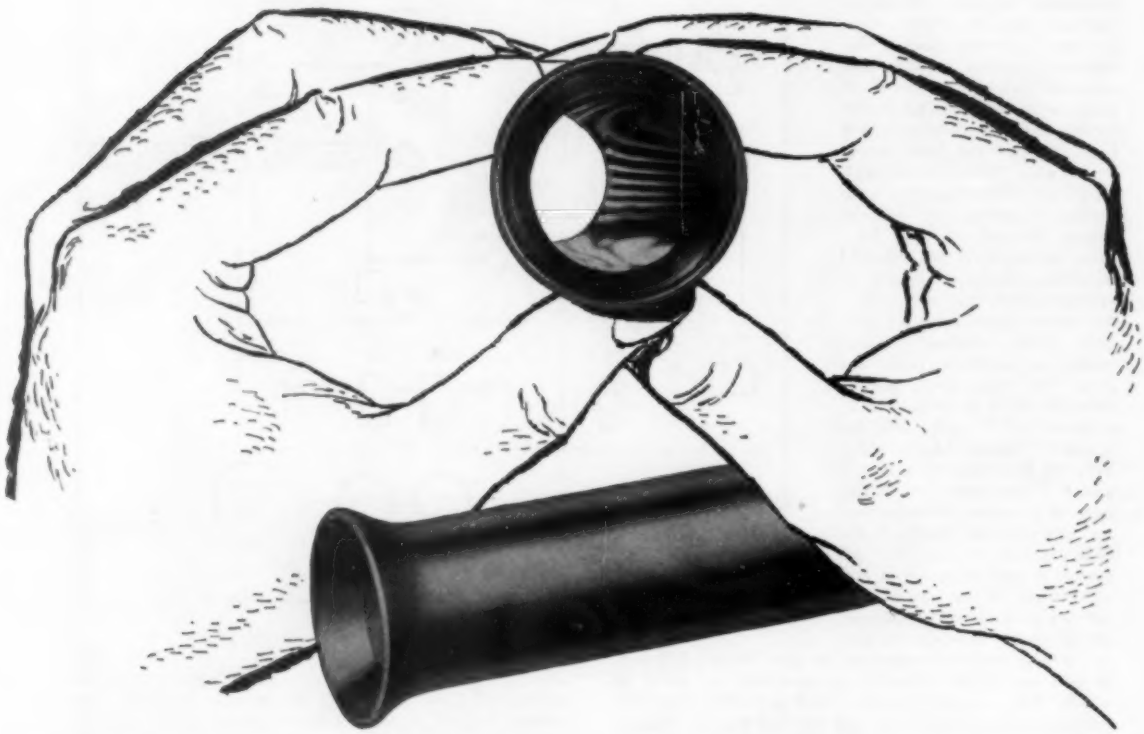
The speed and torque of the motor are varied together by varying the displacement. Increasing the displacement increases torque and decreases speed. Decreasing displacement decreases torque and increases speed, maintaining a constant horsepower.

The cutter motor is controlled by a handwheel for speeds from 900 to 3000 rpm. Below 900 rpm a bleed-off flow control circuit is used. This limits pressures in the cutter motor circuit to that actually required by the load and eliminates spilling fluid over the relief valve generating heat. ▼▼▼

During 1956 AH also published these articles on fluid motor design and application:

Feb.—*Hydraulic Motors*
Mar.—*Cam Sequenced Index Table with Fluid Motor Drive*
Apr.—*Speed and Torque Output from Hydraulic Transmissions*
May—*Pneumatic and Hydraulic Controls for Fluid Motor Drives*
Sept.—*Proportional Braking With a Fluid Motor*
Nov.—*Fluid Motors Combine with Analog Computer to Test Jet Controls*
Dec.—*Servo Speed Control for a Hydrostatic Drive*
Dual Fluid Motors for Two Speed Control
Fluid Motor in Drive Wheels Simplifies Tractor Design
Hydrostatic Transmissions for Mobile Equipment

Cut Hydraulic Flow Resistance . . . Specify HYDRALUSTER the Only "rifle-barrel" Tubing



AXIOM: The smoother the surface, the less resistance offered. And here you see the inside of a section of HYDRALUSTER tubing . . . photographic proof of a super-smooth surface.

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Produced in standard hydraulic sizes, Hydraluster is a premium tube sold at standard hydraulic tubing prices.

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PUSH BUTTON CONTROL

PART 2

• By Kenneth B. Rexford

In the application of pushbuttons, selector switches, and indicator lights the human element plays an important part. The operator starts, stops, selects, tests, or obtains a visual indication of a particular operation on a machine through his action or senses. Thus the ability and convenience of the operator is an important factor in designing control panels.

THREE of the most important factors that the designer must consider in the application of machine controls are:

1. Safety of operating personnel and equipment.
2. Maximum visual indication of machine functions for operational information and safety.
3. Complete control, with flexibility of operation.

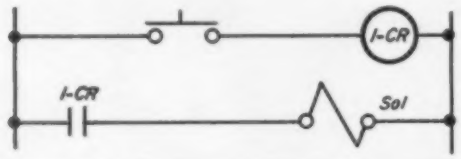
The proper arrangement of control panels, and correct location

KENNETH B. REXFORD, *Chief Electrical Engineer, Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

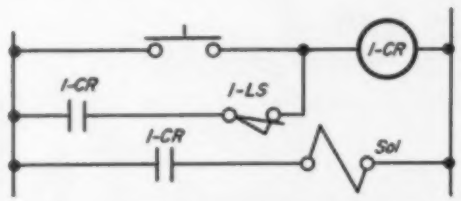
of controls can contribute much to the safe operation of a machine. JIC standards specify shape and color of pushbutton switches for stopping and starting, and indicate proper location with respect to other controls. On large installations where the main control station is out of sight or not readily available to all operating personnel, it is desirable to have emergency reverse or stop switches mounted at various points. These normally closed switches are connected in series with the main stop or reverse switch.

In applying indicator lights, some of the machine functions which should be monitored are: (a) power on, (b) pressure conditions satisfactory, (c) heat conditions satisfactory, (d) safety gate or barrier not in position, and (e) proper conditions of position and time.

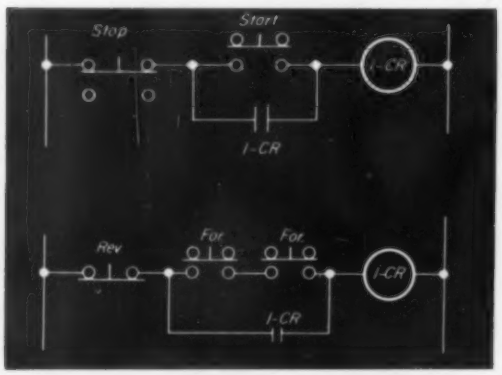
The circuits shown on these pages indicate a number of applications of pushbutton switches, selector switches and indicator lights which permit simple control of complex machine operations. ▼▼▼



In the simplest application, a momentary contact push-button switch closes a circuit to a relay which in turn energizes a solenoid valve. As long as the switch is depressed, the valve remains actuated.

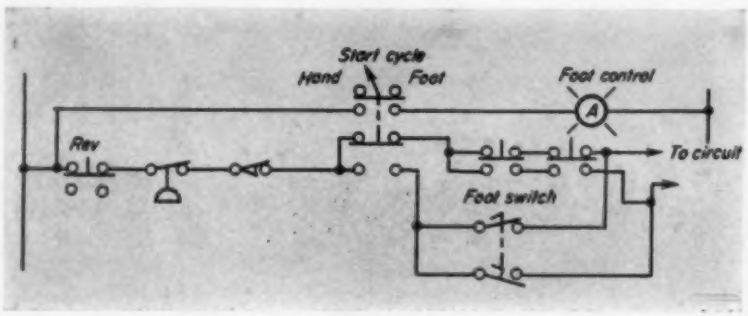


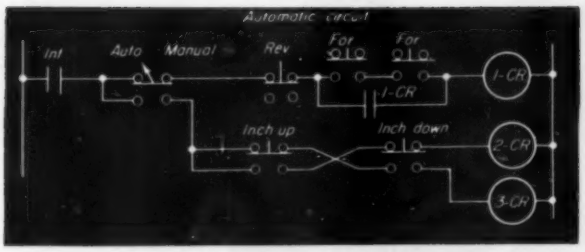
In order to maintain actuation of the solenoid valve after a momentary actuation of the pushbutton switch, an interlock circuit consisting of a normally open contact of the relay and a contact actuated by time, pressure or position is connected across the pushbutton switch. It is generally good practice to actuate the solenoid with a relay unless the solenoid is small and draws a low inrush current or has infrequent operation.



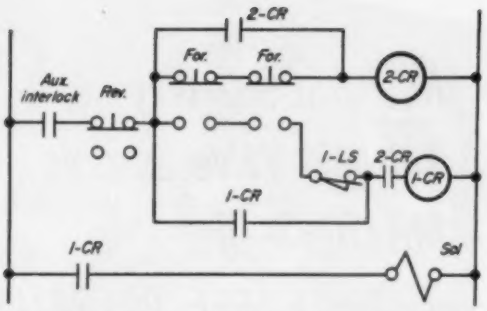
Connecting a normally closed pushbutton switch in series with a normally open unit results in a familiar motor starter circuit. In many applications, particularly in press operations, it is necessary for safety to require that the operator use both hands to start a cycle. A second normally open pushbutton unit is added in series. The two normally open pushbottons are connected in series with a normally closed pushbutton for deenergizing the circuit.

In place of a hand-operated pushbutton, a foot-operated switch can be used. The circuit considerations are the same as with the hand-operated unit. The operation may be set up for a hand or foot operation by connecting a selector switch in the circuit. The normally open contacts on the REVERSE switch have not been used. It is generally not good practice to use these contacts for any auxiliary purpose, because the normal actuation given to a reversing switch may be too short to assure good contact. Actually the main function of this switch is to open a circuit and it should be limited to that.



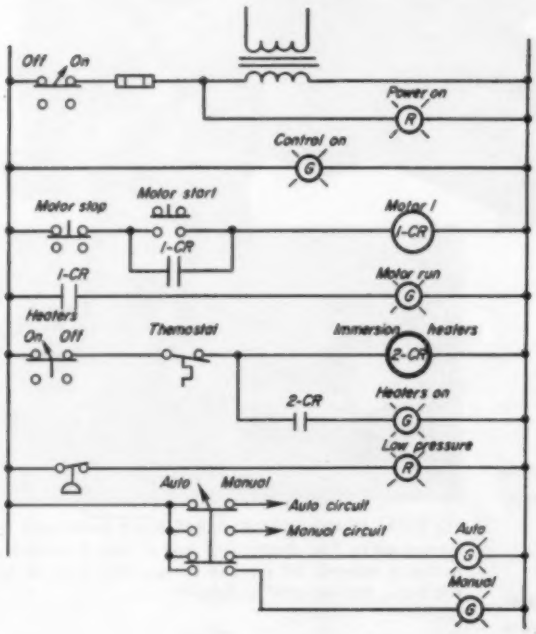


Selector switches are used primarily in setting up circuits by division or isolation of various branches. For example, the isolation of a manual control circuit from an automatic circuit. When it is important that the operation of the manual or automatic cycle be controlled only by qualified personnel, a key-lock selector switch can be used. In the manual circuit, the cross-connection of the two pushbutton units prevents both relays from being energized at the same time if both switches are accidentally depressed at once.



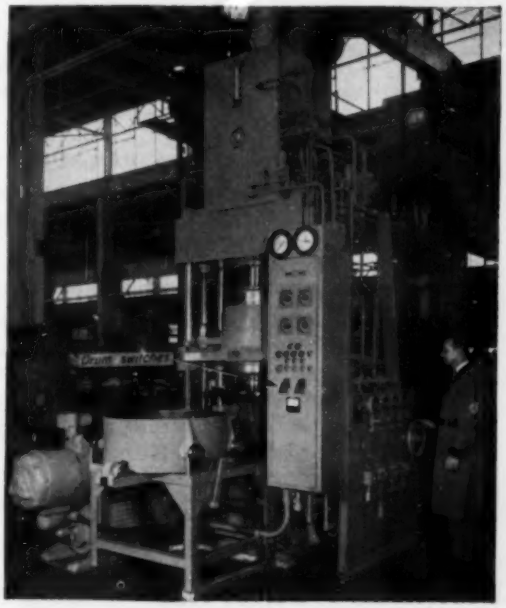
A refinement of two-switch starting prevents tying down one switch. It is assumed that some auxiliary contact such as a motor starter has closed the auxiliary interlock energizing relay 2-CR through the normally closed contacts of the FORWARD pushbuttons. On depressing both of these pushbuttons, relay 1-CR is energized through a contact of 2-CR and a normally open limit switch held closed at the start of the cycle.

At the end of the cycle, the REVERSE pushbutton is depressed, de-energizing both 1-CR and 2-CR. The cycle now returns to its starting conditions. If the pushbuttons have been released to their unoperated condition, the circuit is set up for the next cycle.



As the size of control systems has grown in complexity, indicator lights have become more important for safety and operational efficiency. This circuit illustrates the use of indicator lights to monitor several machine functions.

The two drum switches shown on the control panel of this press represent a special heavy-duty form of selector switch. Drum switches are available with up to 20 poles and 7 positions. The switch can have maintained contact in each position or spring-return to a given position. Many styles and sizes of operating handles are available. While the drum switch has some advantage because of its large operating handle, it can become the target for a great deal of abuse. Instead of gripping the handle, an operator may actuate the switch by hitting the end of the handle giving a tremendous leverage. Where this happens, it is sometimes necessary to use selector switches and pilot relays to obtain long operating life.



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WRITE NOW for your copy of ASCO Bulletin 8316, or have the ASCO Engineer call.

The EXTRA HEAVY FORGED BRASS BODY houses only three moving parts: Two diaphragms and a core. Corrosion protection is assured. All parts in contact with fluids or gases are brass, stainless steel or Buna-N.

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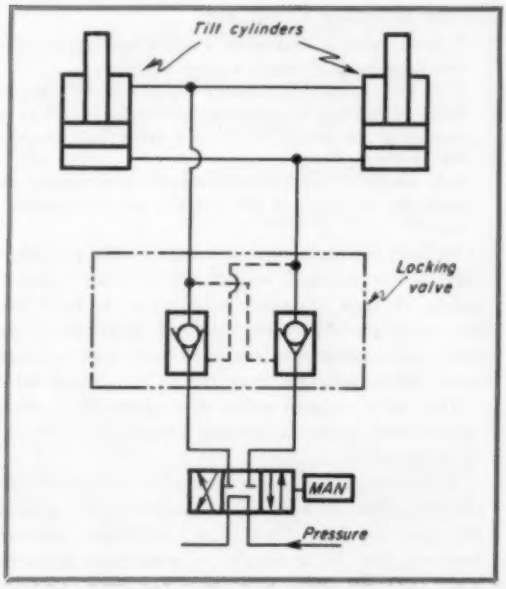
A lift truck operator is a very
busy fellow when he's maneuvering
a load. While his skill and "feel"
of the controls is important,
its up to the designer
of the truck's hydraulic controls
to make the operator's job
simple and fool-proof.
On a new line of trucks,
here's how Clark engineers . . .

HIGH PRESSURE hydraulic system is used on this 4000 lb truck, one of the "Clarklift Line" introduced in 1956.

BUILT-IN SIMPLICITY AND PROTECTION

. . . with 2000-psi control valves

• By Ryan Backofen



DOUBLE PILOT OPERATED check valve locks the tilt cylinders by preventing flow in either direction unless there is pressure on both sides of the cylinder.

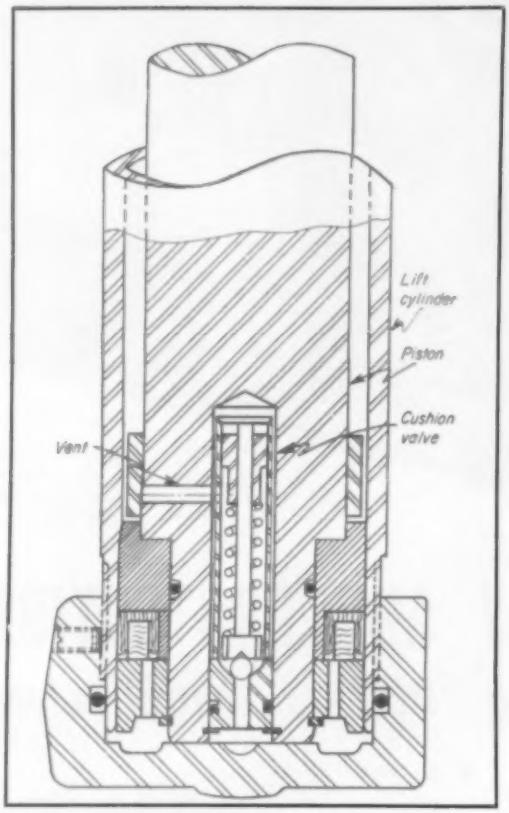
IN developing the hydraulic system for Clark Equipment Company's new "Clarklift Line" two problems were solved which have been troublesome in fork truck hydraulics:

1. Need for an easily serviced multi-action main control valve capable of performing several different functions quickly;
2. Need for a valving arrangement which will provide the hydraulic system adequate protection from shock and overloading.

Operating at 2000 psi, this new system is basically similar to that of conventional fork trucks. From a ten gallon sump oil is pumped by a vane pump with a capacity of ten gpm at 1200 rpm through the main control valve. From here the oil may be channeled for three purposes: lift or lower the forks; tilt uprights backward or forward; and actuate attachments.

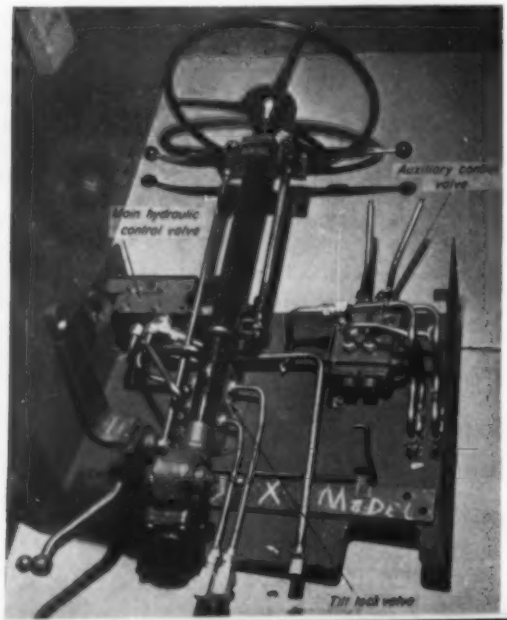
The main control valve which actuates the lift and tilt cylinders is mounted directly under the dashboard, easily accessible and free of long linkages and bell cranks. The control lever actuating the valve is mounted on the right side of the steering column, exactly like the shift lever on an automobile, and is directional; that is,

RYAN BACKOFEN, *Product Engineer in charge of Hydraulics, Industrial Truck Div. Clark Equipment, Battle Creek, Mich.*



BALL CHECK cushion valve is built into the bottom of the lift cylinder piston rod. This cushion takes peak off sudden shock by letting a small amount of oil squirt through a vent line.

VALVE ASSEMBLY will be located below the truck dashboard. The main valve has a built-in relief; control spool for tilt cylinders, control spool for lift cylinder; and a spool which directs oil to auxiliary control valve being used for attachments.



the operator pushes the lever down to lower the forks, pushes the lever forward to tilt the uprights forward, and so forth. When the main valve is in neutral, oil flows through the valve back to the sump.

VALVE DESIGN

The most important mechanical feature of the main valve is its feathering control action. This gives the fork truck operator complete control of the speed of lifting, lowering and tilting. Such control is possible by the arrangement of ports on the spools within the valve which bleed off neutral or low pressure lines rather than high pressure lines. While it is common to use high pressure lines for this purpose, the feathering or cracking action is jerky because of the induction of high pressure. This smooth action is particularly advantageous when the operator is placing a load; with precise control of the action he can place the load exactly where desired, and do it without fear of disclocating the load with sudden, sharp movements.

A second feature of this main valve is its adaptability for auxiliary valves to control attachments. A few years ago use of fork truck attachments was relatively uncommon, and installing auxiliary valves for their control necessitated a major reworking of the hydraulic system. Now the trend is toward wider use of attachments, so the main valve was designed for simple modification to provide for one, two or even three of these valves.

VALVING FOR PROTECTION

In a conventional fork truck the "danger" points of the hydraulic circuit are:

1. In the main control valve, where a build-up of excessive pressure might react against the pump;
2. In the lift cylinder, where a fracture might occur because of too-fast dropping of heavily loaded forks or because of the sudden shock of a heavy load bouncing over a rough floor;
3. In the tilt cylinder, where formation of a vacuum may cause loss of control of the uprights, possibly toppling a load.

In both the main control valve and the secondary valving, the circuit is well protected at all "danger" points. A high pressure relief valve is built into the main control valve itself. If attachments are used, the auxiliary valves have their own pressure relief valve, separate from the main control valve.

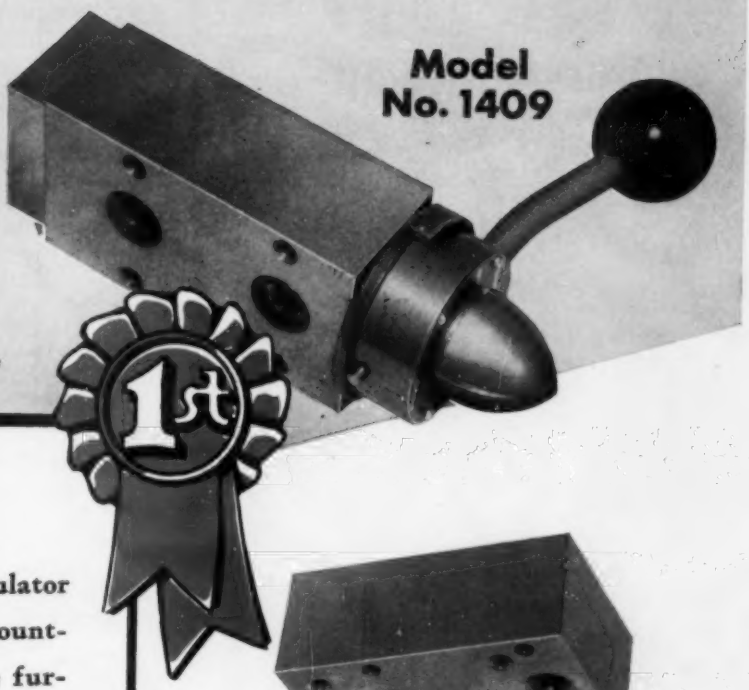
The main control valve also contains a check valve which prevents reverse action from a build-up of pressure.

A flow regulator in the bottom of the lift cylinder allows a free flow of oil during the lifting cycle but controls the outflow of oil when the forks are lowered. Set to maintain a maximum lowering speed of 80 fpm, the flow regulator prevents loads from dropping too fast even when the op-

Concluded on page 84

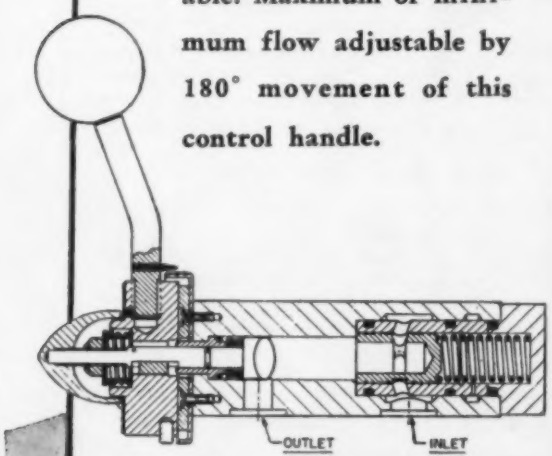
Another WATERMAN WINNER

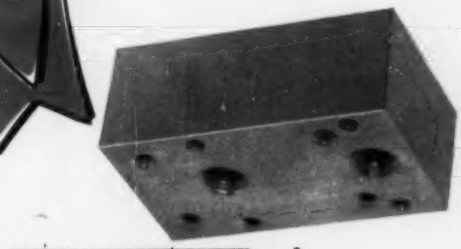
Adjustable Flow Regulator



An adjustable flow regulator adapted for manifold mounting. Sub-plate kits are furnished with built-in check valves for free reverse flow. They are interchangeable, dependable, light-weight and easily installed.

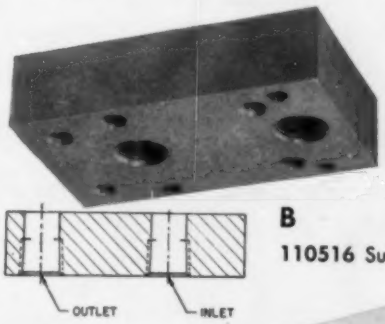
Either right or left hand rotation of control handle is available. Maximum or minimum flow adjustable by 180° movement of this control handle.





A

110534 Sub-Plate Kit with built-in check valve for free reverse flow.



B

110516 Sub-Plate Kit.

Write for illustrated bulletin A, describing the many valuable features of this Adjustable Flow Regulator.

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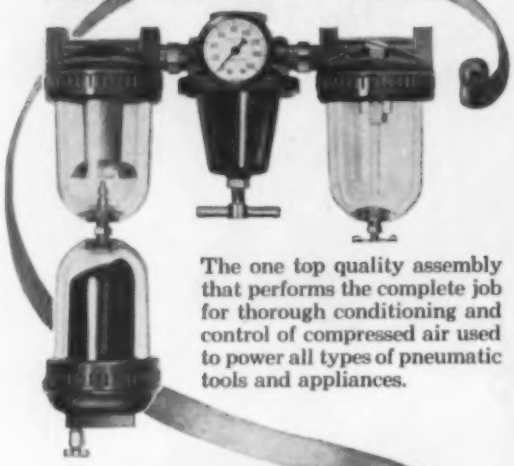
ARROW
AUTOPNEUMATIC CONTROL



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The AUTOPNEUMATIC CONTROL ASSEMBLY features . . .

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high flow capacity with filtration as required and low pressure drop.

. . . The ARROW REGULATOR

high flow capacity with positive pressure control.

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high flow capacity with correct oil mist lubrication.

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LIFT TRUCK HYDRAULIC SYSTEM

Concluded from page 82

erator pushes the control lever to maximum lowering position.

In the bottom of the lift cylinder piston rod is a ball check cushion valve which takes the peak off sudden shocks by letting a small amount of oil squirt through a vent line.

Loss of control of the uprights, caused by formation of a vacuum in one of the other end of either tilt cylinder, is averted by a double pilot operated check valve in lines to each cylinder. This valve prevents oil from flowing in either direction unless there is pressure on both sides of the cylinder.

EASE OF MAINTENANCE

All valves have easily accessible pressure-check points to insure their receiving proper maintenance. Self adjusting packings are used on tilt cylinder rods. Any leakage is a signal that the packings have to be replaced. Straight threads with O-ring seals are used at all ports and mechanical seals are used for hose end fittings. On most models the tilt cylinders are mounted on self-aligning bushings to eliminate any side thrust resulting from a possible misalignment between the frame and the uprights. A hydraulic oil filter with a capacity of one quart per minute is standard equipment. ▼▼▼

"Wipe out" PACKING FAILURES WITH *Seal-Guard* METALLIC ROD WIPERS

Self-adjusting, easy to install, Seal-Guard's knife-like bronze rings "wipe off" all dirt and grime, will not mar the rod, are oil and heat resistant and friction-free.

HOW SEAL-GUARD WORKS

1. **Twin wiper rings are mounted on rod with notches staggered.**
2. **Cushion ring is compressed on assembly exerting constant inward pressure keeping ring in constant contact with rod.**
3. **Harmful substances are completely cleared by scraper action.**

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SERVO CONTROLLED ELEVATORS

Concluded from page 60

piston sheaves, around end sheaves, over the overhead sheaves to cable hitches on the platform.

ELECTRICAL CONTROL

The elevator is equipped with semi-automatic pushbutton control. To raise the elevator, the operator presses the UP button momentarily. This starts the pilot motor rotating in the proper direction and energizes a magnetic clutch which disconnects the pilot motor from a brake in the manual control station. The differential action of the control unit opens the main valve until the elevator reaches the design speed.

When the elevator approaches the flight deck, a switch mounted on the cylinder is opened by a cam on the piston. This de-energizes the pilot motor and the magnetic clutch connecting the pilot motor shaft to the hand control shafting and stopping the pilot motor. The cylinder travel is fed into the servo unit closing the valve.

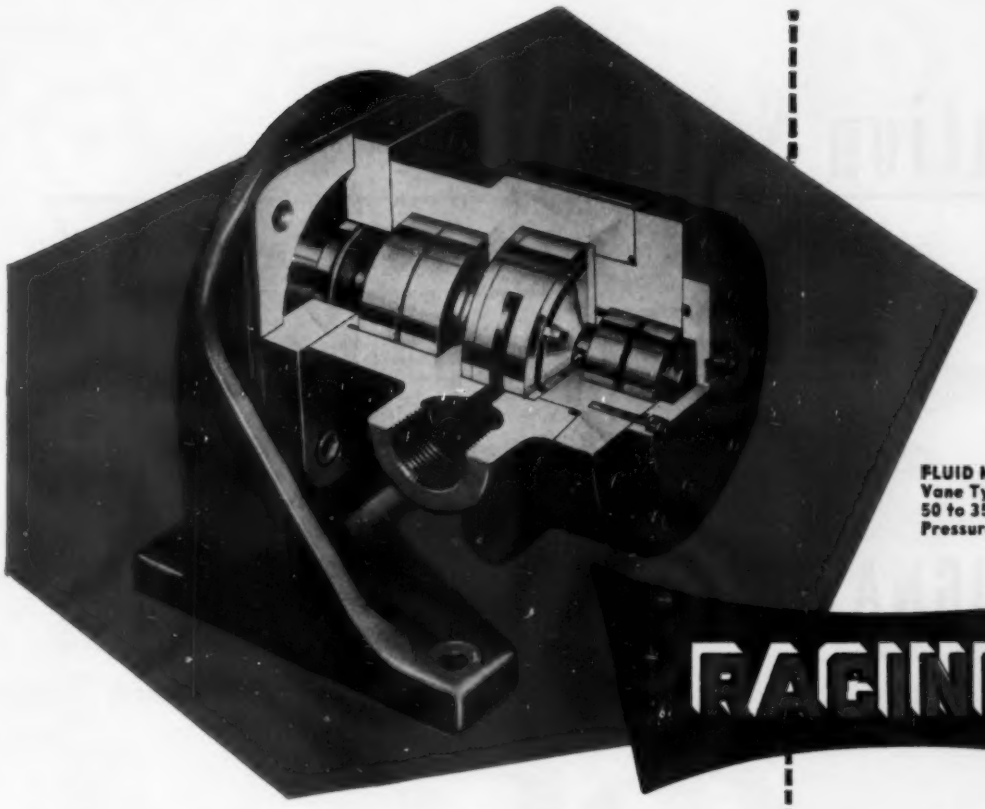
MECHANICAL STOP

During automatic operation of the elevator, the platform is slowed down at the top and bottom by limit switches which stop the pilot motor. During manual operation of the elevator, this electrical control is inoperative, so a mechanical terminal stop is provided to limit the allowable platform speed as a function of the distance from the elevator terminal.

The speed of the elevator is function of the valve opening. A roller is fastened to the cylinder piston, and a cam is provided at each end of the piston travel. These cams are linked to the control valve so that for normal closing of the valve and resulting elevator slow-down, the cam will be moved out of the path of the roller. If the valve is not closing properly as the platform approaches the terminal, the roller hits the cam and sets a brake on the pilot motor. The elevator travel then closes the valve and decreases the elevator speed. This mechanical terminal stop also serves as a safety device if the electrical stopping mechanism does not function correctly during automatic operation. During automatic operation, a limit switch is set so that the cylinder piston contacts positive stops before the valve is completely closed. This keeps pressure on the cylinder piston when the platform is at the flight deck.

Actually several switches are set at various distances from the positive stop. Switches which indicate the valve opening are connected to these switches. Because of variations in tank pressure, elevator load, etc., the position of the control valve varies to maintain a constant elevator speed. The valve position switches then select the proper stopping switch in order to maintain a predetermined speed on hitting the positive stops. ▼▼▼

An index to servo articles published in 1956 appeared in the December issue. A complete servo bibliography for 25 years is in the Fluid Power Engineering Index Published by AH.



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DESIGNATING FLOW RESTRICTORS

• By D. M. Bruce and K. G. Hancock

The method of using drill numbers to designate the size of restrictors is of little value, because of the variation in flow between orifices of the same diameter but different shape. The designation system described in this article overcomes this difficulty and gives a series in which the percentage variation of flow between consecutive sizes remains constant.

MANY methods have been used to designate restrictors. Some companies indicate the size of the orifice. Others indicate the rate of flow for whatever pressure drop the particular restrictor is designed. There are objections to both these methods.

If the diameter of the orifice is indicated, a number based on an assumed coefficient of discharge will probably be used in designing the application. Later, during the testing stage, this coefficient may not be realized, and the design will require changes.

When the designation refers to the flow, it gives no indication of the restriction offered, unless the design pressure drop is known. Two valves with the same flow designation may have widely different design pressure drops and thus offer totally different restrictions. A further difficulty of this method is that a wide range of flows must be covered, and the flow designation may require many figures.

FLOW NUMBER SYSTEM

A rating system using mathematically developed flow numbers has none of the disadvantages of designating by size of orifice or rate of flow, and it results in a range of restrictors graded to meet all requirements. Only a limited number of sizes are required and once the basic design of a restrictor has been determined, the system can be extended to a range of restrictors differing only in flow.

Using flow numbers, a range of standard orifices are specified by the flow which they pass with a standard fluid

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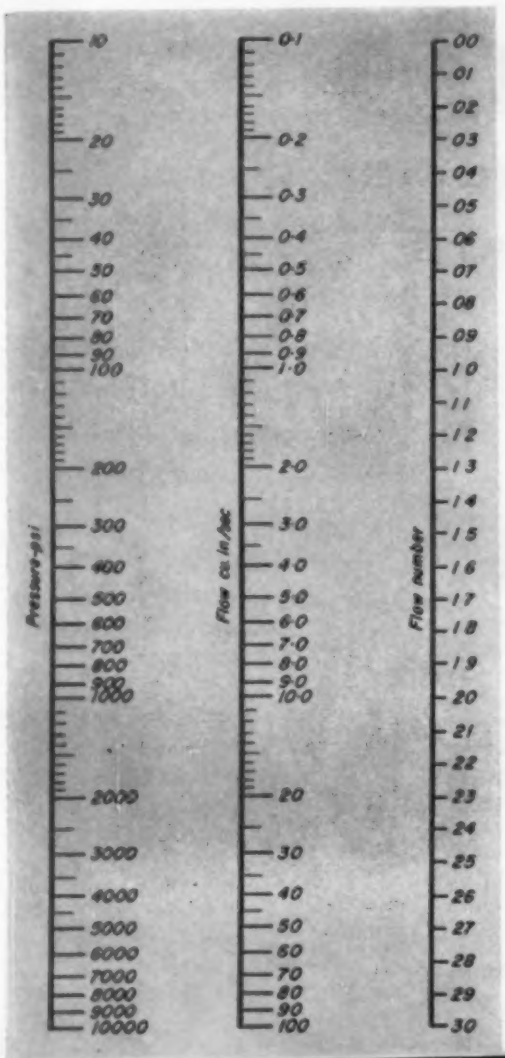
DESIGNATING FLOW RESTRICTORS

AVIATION

at a standard pressure drop. For aircraft hydraulic systems it is convenient to take Specification MIL-O-5606 fluid at 68 degrees F and a pressure drop of 1000 psi. A logarithmic scale of flow is used to maintain a constant flow differential between successive numbers. It is convenient to use 20 $\log_{10} q$ as the flow number, where q is the flow in cu. in/sec. A range of standard orifices denoted by a 2-digit number between 00 and 40 covers a flow range from 1 to 100 cu. in/sec with approximately 12% differential between successive numbers. This is practical for most aircraft applications.

The standard pressure drop of 1000 psi is convenient for production testing and is of the same order as the probable working pressure drop. The coefficient of discharge is therefore likely to remain the same between standard and working conditions, and a simple nomograph as shown in Figure 1 can

FIG. 1. FLOW NUMBER is determined when pressure drop and flow are known.



be constructed to give flows for pressure drops other than 1000 psi.

A tolerance of ±12% is generally adequate for restrictors, so that limits are one flow number more or less than the one specified. Special tolerances can be denoted by 3-digit flow numbers in which the third digit follows the decimal point. A 3-digit flow number specifies a flow to better than 0.6%.

ADDITIONAL RESTRICTOR DESCRIPTION

The flow number system may be extended to give full design information for the restrictor. In Table I the following additional information has been included:

a. The approximate size of the orifice and the drill size if it is to be finished by broaching. Above flow number 17, broaching should not be necessary.
b. Whether the orifice needs to be protected by a filter, and if so what type.
c. Whether an unfiltered labyrinth restrictor is practical, and if so how it should be constructed.
d. The test flow and its limits.

When labyrinth restrictors are required, Table I shows how many plates are required to give equivalent characteristics. To cover the flow rates commonly encountered in aircraft hydraulic systems, it has been found advisable to have three types of labyrinth restrictors, differing from each other only in the size of orifice in the plates. Types A, B, and C correspond to single plate flow numbers 24, 27, and 30. The type should be selected which gives 4, 5, or 6 plates, because a labyrinth restrictor for such a purpose must have a nominal number of plates not less than 4, in order that adjustment by adding or removing one plate should not alter the flow number of the component by much more than 1. If the nominal number of plates is much greater than 6, the size of the labyrinth type component would then become greater than that of one with a single orifice and filter. None of the labyrinth restrictors require filters.

USE OF FILTERS

When small diameter orifices are used, it must be determined whether local filters are required to protect the orifice from becoming blocked. Although this depends on how dirty the fluid is, it seems reasonable to take the size of orifice in the connector used with the smallest pipes as a basis for deciding when local filters are advisable. From British Standards, the orifice in the connector for 3/16-inch pipe is .092 inch. The minimum size of orifice which does not require a local filter has been taken as 90% of this value, or .08 inch. Therefore any hydraulic valve containing an orifice less than .08 inch shuold have a local filter.

Having suggested where local filters are necessary, the question of the size of the filter area has to be determined. This is probably much more

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AVIATION

difficult because it depends on many unrelated conditions. Assuming that filtered fluid is used for replenishing the reservoir, and that adequate line filters are used in the system, one possible basis is to arrange the filter area so that 50% of the flow may be blocked without changing the flow number of the complete valve by more than 1. That is, if the valve were initially set to nominal flow requirements, it would be within tolerance after a period of service when the filter was 50% blocked. It can be shown that to achieve this, the flow number of the unblocked filter must exceed that of the orifice by 12 or more.

On these assumptions it is possible to deal with all flow numbers from 00 to 27 (the point at which filters are not required) by two types of filters: a small one covering numbers 00 to 13, and one slightly larger covering numbers 14 to 27. A wire-wound type filter which will take out particles above .005 inch is suitable for this application. A typical local filter is illustrated in Figure 2.

NON-STANDARD FLUIDS

If occasional use is made of a fluid having a different specific gravity from the standard .85 of MIL-0-5606 fluid at 68 degrees F, the standard orifices indicated by the flow number classification can still be used. To understand how to do this, it must be remembered that a flow number is a means of designating a standard orifice, and the use of a standard fluid is merely incidental to specifying the size of this orifice.

Assuming that the coefficient of discharge of an orifice remains constant, the flow resulting from a given pressure drop will be inversely proportional to the square root of the fluid density. The flow of fluid of specific gravity S will be $\sqrt{.85/S}$ times the values given in the nomograph of Figure 1. Conversely, if pressure drop and flow are specified for a non-standard fluid, then this flow should be divided by $\sqrt{.85/S}$ to obtain the equivalent standard flow before using the nomograph to determine the flow number.

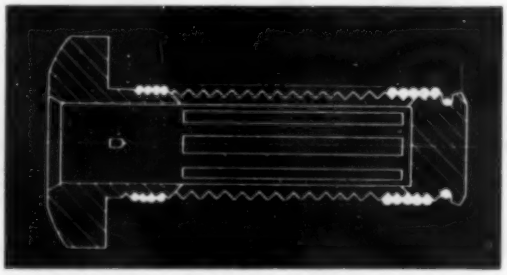

FIG. 2. TYPICAL LOCAL FILTER for use with restrictors. The wire-wound type filter will take out particles above .005 inch and is required for restrictors up to flow number 27.

Flow No.-N	Flow in cu. in./sec at 1000 psi pressure drop	Drill size No.	FILTERS REQUIRED N=25	FILTERS REQUIRED N=39	LABYRINTH RESTRICTOR No. OF RESTRICTOR PLATES Type A	Type B	Type C	Approx. dia. of orifice-in.
00	1·00	79						·017
01	1·12							·018
02	1·26							·019
03	1·41	78						·021
04	1·58							·022
05	1·78							·023
06	2·00	76						·024
07	2·24							·026
08	2·51							·027
09	2·82	73			32			·029
10	3·16				25			·031
11	3·55				20			·033
12	3·98	69			16	32		·034
13	4·47				13	25		·037
14	5·01		↓		10	20		·039
15	5·62			↑	8	16	32	·041
16	6·31	64			6	13	25	·043
17	7·08				5	10	20	·046
18	7·94				4	8	16	·049
19	8·91				3	6	13	·052
20	10·0					5	10	·055
21	11·2				2	4	8	·058
22	12·6					3	6	·061
23	14·1						5	·065
24	15·8				1	2	4	·069
25	17·8						3	·073
26	20·0			↓				·077
27	22·4					1	2	·082
28	25·1							·087
29	28·2							·092
30	31·6						1	·097

Table I—Restrictor information and requirements.

DERIVATION OF FLOW NUMBERS

Two-digit flow numbers designate a series of standard restrictions arranged so that the flows passed by the successive members of the series are in geometeric progression. The percentage flow change between one restrictor and the next remains constant throughout the series. The required series of numbers are given by

$$N=(1/\log R)\ \log Q \quad \text{..... (1)}$$

where: N=Flow number
Q=Flow — cu. in./sec
R=Flow ratio between successive members of the series.

The next member will have a flow of QR and a flow number of

$$N=(1/\log R)\ \log QR$$
$$=(1/\log R)\ (\log Q+\log R)$$
$$=N+1 \quad \text{..... (2)}$$

As an example, if a series of numbers is required to give 10% increments, then R=1.1 and

$1/\log R=24.16$

For the flow numbers used in this article,

$1/\log R=20$

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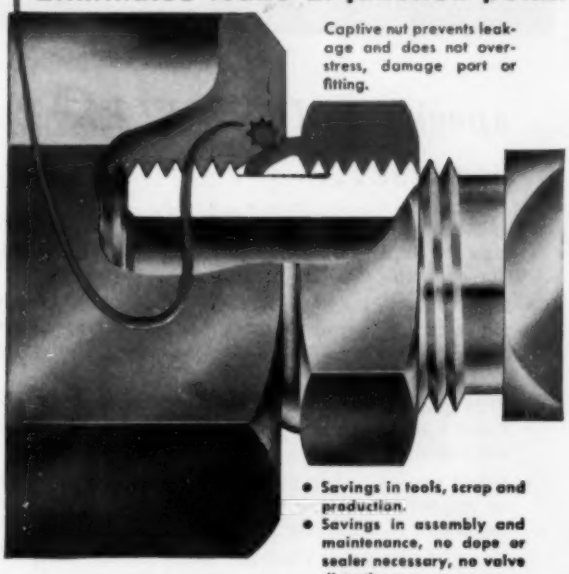

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DESIGNATING FLOW RESTRICTORS

AVIATION

flow number change of 6 when the flow is doubled, and a change of 20 when the flow is multiplied by 10.

The nomograph of Figure 1 is based on the assumption of a constant coefficient of discharge for the standard test and the working conditions. Thus

$$Q^2=q^2(1000/P) \quad \text{..... (3)}$$

where Q is the flow under the standard 1000-psi pressure drop and q is the corresponding flow with a pressure drop p.

Since

$$N=20 \log Q$$

Substituting for Q

$$N=20 \log Q+30-10 \log P \text{.....(4)}$$

RESTRICTOR APPLICATION

In selecting a restrictor, the flow number is determined from the nomograph of Figure 1, or if greater accuracy is required, by calculation from formula (4). This number should be entered on the drawing together with the specified flow and limits found from Table I.

If the orifices are sized by broaching, the drill size can also be found in the table and should be entered on the drawing. ▼▼▼

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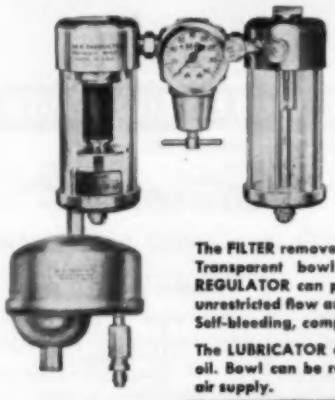

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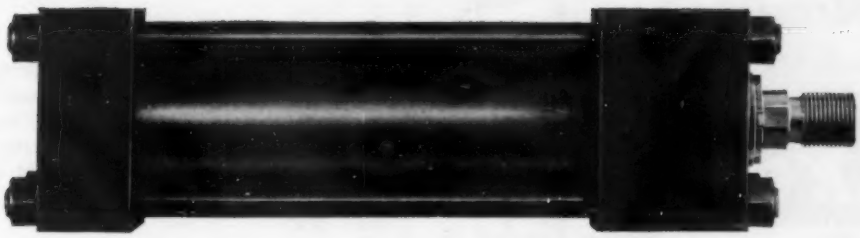

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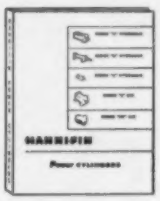

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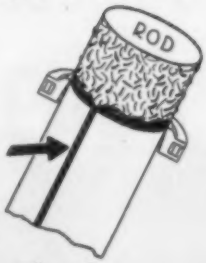

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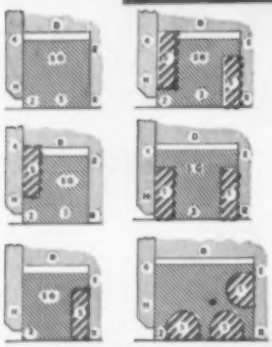

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HIGHLIGHTS OF SAE

In this article APPLIED HYDRAULICS reports the action and discussion of the SAE Committees which are concerned with hydraulic and pneumatic equipment. This report covers meetings held October 1956 in Los Angeles. Meetings of these committees will next be held the week of April 29th at the Sheraton-Plaza Hotel, in Boston.

PNEUMATIC SYSTEMS

• **Air Reservoirs**—A proposed specification makes available information on the technical requirements for reservoirs in the different temperature and pressure ranges. Work on the spec MIL-R-8573 (Aer) was carried out by Fred Pollard of Republic and H. E. Heigis of Walter Kidde. There is some concern as to the possible number of different reservoirs that would be required under the new spec. In answer, Heigis said that since each reservoir is almost a special item for each application, the spec would not increase the supply problem. Exception was also taken to having both flattening and gun-fire tests. Could one be eliminated? A survey will be made to get airframe manufacturers' opinions. Exception was also taken to paragraphs on acceptable coatings. A revision is to be prepared.

• **Systems Design**—Bureau of Standards is preparing a circular covering a new capacity factor termed an Area Factor. This is a dimensionless parameter which compares the flow through the valve to the calculated isentropic flow through an area equivalent to the inlet area of the unit. A revised test set-up, to be used in measuring the flow through units is also described.

• **Grease**—Discussion indicated a need for a better grease for aircraft pneumatic systems. Services were requested to expedite work in this area. Unsatisfactory experience was reported with MIL-L-4343 grease on Buna N and other rubber seals.

• **High Temperature**—A-6 committee chairman B. R. Teree summarized discussion on this subject by pointing out to the Services that pneumatic equipment manufacturers are handicapped by a lack of clear requirements concerning cycling, low temperature, types of systems, etc. He requested specific requirements from the Services.

• **Pneumatic Application**—Will increased use of pneumatics be made on American aircraft? George Osterseteer of the Fokker Company in Holland told the more than 300 men attending this meeting of the pneumatic work which has been done in Holland. He expressed disappointment in finding that greater use of pneumatics is not being

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1	18	35	52	69	86	103	120	137	154	171	188	205	222	239	256	273	290	307	324
2	19	36	53	70	87	104	121	138	155	172	189	206	223	240	257	274	291	308	325
3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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made in this country in spite of the excellent theoretical work that has been done.

TYPE II 275° F HYDRAULIC SYSTEMS

• **Seals**—Reports indicate that O-rings made to MIL-P-18017 have been very effective from —65 to 275 F. It is expected that a new standard, good for Type I and Type II systems will be issued to replace MS 28784 and AN 6227.

Tests of MS 28784 and AN 6227 O-rings were discussed. There was agreement that for systems up to 225°F both compounds are satisfactory.

Revisions to MIL-P-5514 were reported. This is a general spec concerned with installation and gland design for both hydraulic and pneumatic components. Because the revision ignored pneumatics it was requested that subcommittee A-6B prepare a spec to cover pneumatics.

Testing and standardization of the metal boss seal was discussed. Services plan to issue MS 24382 and then issue drawing covering fittings as well as installation of the boss seal. Successful tests with steel fittings for 275°F have been made. Testing with aluminum fittings is going on. Discussion indicated that very much work must still be done to arrive at a standard. The need for presetting the seal was questioned. Suggestion was made that change of the 120° angle on the boss to 70° would eliminate the need of presetting the seal.

It was also pointed out that the presently recommended 1020 steel for the boss is subject to corrosion and that presetting is even more difficult in the field than in production.

As a result of tests, the committee recommended that the Services issue a standard drawing equivalent to AN 6290 which utilizes MIL-P-18017 materail for boss seals for 275°F operation.

TYPE III 400° F (and over) HYDRAULIC SYSTEM

• **Fluids and Seals**—Bernard Rubin of WADC reported that mechanical tests on MIL-H-8446 silicate-ester type fluids would be completed early in 1957. Physical and chemical tests have been completed. A progress report by Rubin and Harry Schiefer on hydraulic fluids for 400 F was published in the July 1956 issue of APPLIED HYDRAULICS.

Mr. Rubin noted that improvements in the chlorinated phenyl silicones have resulted in fluid modifications. One of the modifications contains an additive which improves oxidation stability. The other modification has been the addition of a tin compound which has shown improvement in wear preventative properties. However, the tin modified

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The SEALOL BALANCED PRESSURE SEAL, incorporating the differential area principle, has proved unusually versatile and efficient in rotary shaft sealing applications of all kinds. If your particular sealing requirements are not listed among the actual sealing applications tabulated here, request Bulletin 7 for complete data.

RPM	Shaft Size	Temperature	Fluid	Pressure
36,000	¾"	200° F	Aviation Fuel	300 PSI
1,800	1⅛"	Room Temp.	Ucon Hydraulic Fluid	1500 PSI
11,000	2¼"	200° F	Lube Oil	20 PSI
6,800	5"	125° F	Lube Oil	Atmos. Pressure
80	2¾"	350° F	Steam & Hot Air	Atmos. Pressure
7,700	5⅛"	350° F	Lube Oil	2 PSI
53,000	1"	350° F	Oil & Steam	350 PSI
70,000	½"	230° F	Oil Mist & Air	19" Hg. abs.

Slightly modified versions of the basic Sealol seal make it suitable for almost any rotary shaft sealing application.

RPM	Shaft Size	Temperature	Fluid	Pressure
12,000	2¼"	—300° F	Liquid Oxygen	250 PSI
30,000	1⅛"	125° F	90% Hydrogen Peroxide	60 PSI
14,000	1⅞"	160° F	Fuming Nitric Acid	200 PSI
10,000	¾"	300° F	Propyl Nitrate	150 PSI

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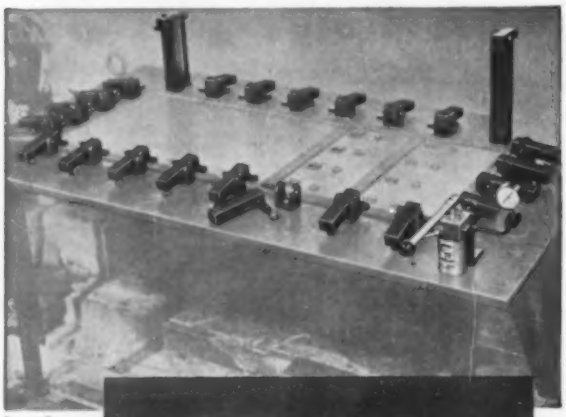

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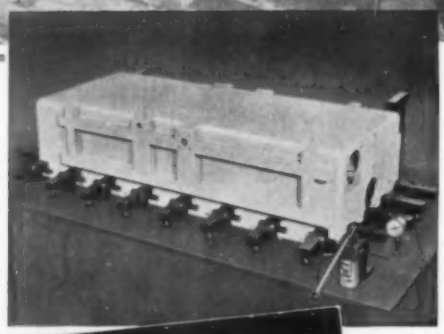

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silicone has much higher low temperature stability than the original phenyl silicones.

Reporting on evaluation of 6 of 10 fluids obtained on a custom synthesis basis, he noted that three had been chosen for further study, however, none of these fluids are available even in limited quantities commercially. A high temperature circulation stand being built by WADC is near completion and as soon as completed, fluid evaluation at 550°F would start. Six fluids are awaiting test, namely MLO-8200, OS-45-1, F-50. F-52 tin modified and two mineral oils.

Mr. Rubin also discussed spontaneous ignition. Curves presented earlier and in the AH article have been lowered by further testing.

WADC's E. R. Bartholomew reported on elastomers. Testing and evaluation of MIL-P-18017 compounds makes it evident that present elastomers have gone as far as they can go. He noted that new polymers are being worked on and that one of the properties of these new polymers will be resistance to all fluids now in use. Therefore, fluids will no longer be a consideration in the use of these polymers. He added, however, that the new polymers have deficiencies between 400° and 500°F, and allowance for compression set will have to be designed into the seal installation. He reported that the air force has contracted with Boeing Aircraft on a study of seals and seal cavities.

• **Type III Experience**—Fred Pollard of Republic reported on testing of Viton A, a DuPont material. In a rod seal application at 450°F, tests were run with both the Viton A and Poly FBA The tests were subsequently conducted at 500°F. One thing was evident, the Viton A has more resistance to thermal cycling. Leakage with Poly FBA has previously been observed at room temperature after very few cycles. Viton A rings finally wore out after 94,000 cycles, however, no leakage was observed up until wear out.

Supply of Viton A compound is extremely short.

C. W. Galloway of Douglas reported testing loaded backup rings, loading being accomplished with either boron or copper chrome. Tests using a copper chrome spiral teflon backup ring were satisfactory. The backup was of a serrated type, however, at 400°F the serration split. Tests on the packing are being stopped until a satisfactory backup is found. His tests were in variance with others made on Duroid backup. In his tests the Duroid particles gouged the cylinders at high temperatures.

George Keller, North American, said Duroid was excellent, however, hardened materials must be used with it. Frank Straus, WADC, said that use of a nitrided cylinder barrel will show a honing effect using a Duroid backup, whereas with 4130 steel there will be a scoring condition. He emphasized that material selection is extremely important in the use of such backups.

• **Entrained Air**—G. C. Newell, Boeing, said, "Recent tests at Boeing indicate a severe reduction

in fluid bulk modulus at high temperature with all fluids tested. Entrained air further reduces bulk modulus and it appears that deaeration units will be required to maintain 'stiff' flutter-free flight control systems for high speed airplanes.
Silicone fluids which appear most promising for high temperature operation are particularly susceptible to foaming and air entrainment. What is the experience of other companies?"

Answering this question, George Keller said, "Autonetics has had severe flutter problems associated with low bulk modulus of silicate ester fluids at elevated temperatures. Silicone fluids are worse in the manner than silicate ester fluids.

"The problem has two facets. Entrained air certainly makes the fluid springy. However, even when the air is all removed, the fluids still have low bulk moduli at elevated temperature. We have data from WADC which indicate that the bulk modulus of silicate ester fluid is down to 105,000 psi at 300°F. Our own data indicate that the bulk modulus at 300°F is even lower than that. Where such low spring rates are unacceptable, the only design solutions are to reduce the length of the fluid column in compression or to increase the area of the fluid column.

"I suggest that people interested in deaeration read WADC Technical Report 55-144."

• **Cleaner Fluids**—Discussion indicated that while it is feasible to manufacture MIL-O-5606 fluid to a high degree of cleanliness it may not be practical until handling methods are improved. Most contamination occurs in the packaging and installation. Fluids for servo control devices require particular care to avoid contamination.

• **Packing Corrosion**—WADC is conducting tests to determine O-ring compounds which will not cause corrosion. Work to date indicates that presently available additives decrease corrosion but also decrease life of the material.

• **System Reliability**—Six conclusions were drawn by E. T. Raymond of Boeing, who discussed reliability analysis as related to hydraulic systems:

1. The need for reliable hydraulic systems will be greater in future airplanes that it has ever been in the past.
2. Realistic reliability goals can be established.
3. Overall system reliability is dependent upon highly reliable components, leakage being the dominating factor.
3. Over-all system reliability is dependent upon proper arrangement of components.
5. Absolute reliability of systems being designed cannot be calculated; but, mathematical comparisons can be made to determine which system arrangements have the highest inherent reliability under certain assumptions.
6. Undue design compromises need not be paid to obtain optimum system reliability providing proper system arrangement and highly reliable components are obtained.

Remainder of the committee meeting dealt with details of specifications which are in preparation for filters, valves and fittings. ▼▼▼

INSIDE NEW SUPER AUTO-KLEAN. Line-type housing *(shown)* is only one of many arrangements available for this self-cleaning, micronic filter.

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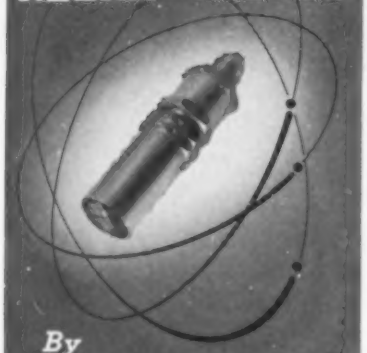
RELIEF VALVES



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PRESSURE RANGE: 500 to 3800 psi
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FLOW: 4 SCFM
INLET PORT: Per AND 10056-4
OUTLET PORT: Free to atmosphere
INTERNAL LEAKAGE: Zero
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Ideas from a Sales Engineer

Elmer F. Heiser

Elmer Heiser has been selling air and hydraulic components for 20 years. During this time he has solved many problems and admits to leaving some unsolved. He is the author of the book "Air and Oil Cylinders in Industrial Applications."

Fluid Power Possibilities

WHO has never said "I wish I had thought of that". How often we see something new and realize that with a little imagination we too should have recognized the obvious need for an obvious product. If you are looking for new markets for fluid power products, you may be interested in some of the possibilities found off the beaten track.

It would be interesting to dig back into the beginnings of some applications and learn what steps were followed in the development, by whom and maybe why. One fellow we recently heard about has spent time, effort and considerable money attempting to build a new though limited market for air and hydraulic equipment. Everyone has similar opportunities as the raw materials of which his idea was born are known to all of us. Take the ordinary house fly, a common and prevalent pest everywhere. Next consider the ubiquitous coat hangers that multiply in every closet until disposal becomes a problem. Contemplating either or both, can you conjure up any new outlet for fluid power products? Add to the combination the increasing leisure of the working man and his quest for recreational pursuits. Do you still draw a blank?

For Health, for Fun, for Profit

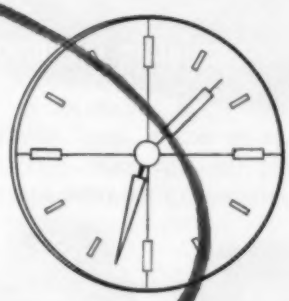
Not this fellow. He contemplated the house fly, the surplus of coat hangers and this added leisure of mankind and came up with an idea. He proposes to de-kink the coat hangers by air and hydraulic means, then with some more of the same, cut and reshape them into sporty fly killers. The weapons would be wire formed, pistol grip, catapults, powered by rubber bands. The killing missiles to be short pieces of surplus hanger wire cut into arrows. The arrows to have blunt rubber tip to reduce the hazards to the surroundings and improve the hunters chances to score.

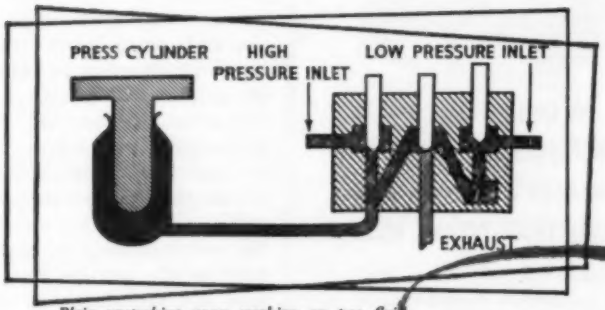
In one swoop this single idea provides recreation, develops new skills, improves the general health and welfare by reducing the population of disease carrying pests, converts an unwanted, useless and universal surplus of coat hangers to practical purposes, and last but not least adds one more outlet for the growing fluid power industry. It shows what a little imagination can do and also proves that it is not always necessary to look far afield in the quest for new products or outlets.

As you can see this field is already being exploited so this is written not to encourage a

AUTOMATION at low cost

For users of hydraulic power, an effective form of Automation is readily available by the simple installation of Ellison air operated valves and a suitable timing instrument. Such an installation costs very little in capital outlay but enables several hydraulically operated machines to be controlled automatically by a single operator. The uses for Ellison valves with timers are varied and numerous. One important advantage is the simple application of safety devices as, for example, automatic control of machine guards to comply with Factory Act regulations. Send for full details and ask to see a valve.





Plain upstroking press working on two fluid pressures with gravity return of ram.

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Ideas from A Sales Engineer

Continued

stampede for the market, but to indicate what can be done!

Gad! A Cow Latrine

We recently had occasion to observe some hydraulic equipment in very practical operation in an out of the way place. Which again points up the importance of associating apparently unrelated fields with our own to find new markets. I found a hydraulic pump, valves and cylinders built into a dairy farm as an important part of the farm operation. For those who are not familiar with dairy farms or dairy barns, it may be in order to describe the situation more completely. In the barn, which in a manner of speaking can be called the factory, the cows stand in rows, each in a stanchion. A cow has two ends of course, and the dairy farmer must be concerned with both. One end which for convenience we can designate as north, he feeds; the other or south end accounts for production. In a large barn there may be quite a few rows of cows engaged in consumption and production. On the end or outside rows the consumption or north end of the cows will be facing the wall; the south end is toward an aisle. Center rows are double rows where the north ends meet. Thus while the cows in the outside rows have only a blank wall to contemplate, the double row occupants have the doubtful, constant advantage of looking only a short distance into the soft eyes of a companion creature.

From the above description it may be clear that there are access aisles between bovine rows and that these passages consist entirely of southern extremities. In addition to consumption duties the barn attendands must frequently attend to the southern production problem. This is where hydraulic equipment enters the picture. Gone are the days of hand raking, shovelling and wheeling to keep ahead of the problem. The modern way places a rectangular formed concrete trench approximately six inches deep by eighteen inches wide in the floor directly behind each row of cows. These aisle trenches run the full length of the row and join a larger transverse trench at the center or end of the barn. Small bore, long stroke hydraulic cylinders are located in the end of each trench to operate long rods or bars which extend the length of the trench. Swinging paddles or gates are attached to the operating arms on centers related to the cylinder stroke. The gate and operating rod mechanism is so designed that on an advance stroke the gates or paddles first swing out across the trench then move along as scrapers for the balance of the cylinder stroke. On the return stroke of the cylinder the gates fold back parallel with the operating rod. Thus on an advance stroke the contents of the trench is collected into piles at each extended gate and is advanced along the trench a given distance.

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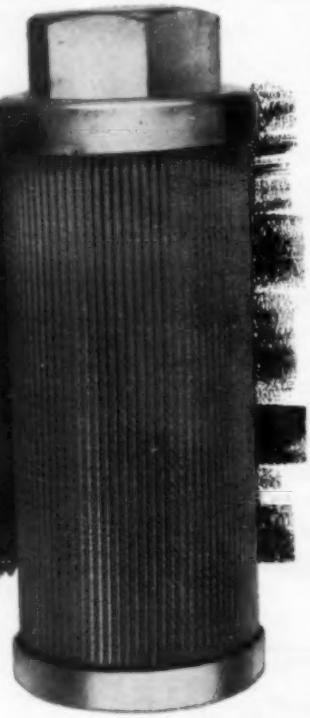

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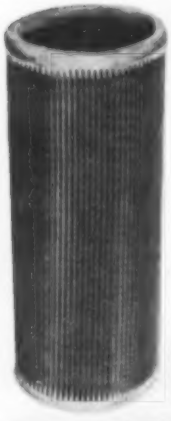

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The piles are left standing when the feed mechanism returns and as the paddles are returning in a folded position each clears the following pile. The cylinder stroke exceeds the pile moving stroke so that the folded gate returns to a point behind the succeeding pile and then swings out to pick it up on the next advance. This stage or step system of collecting requires only a few minutes to clear a long trench and the job is accomplished without an excess accumulation at any point.

While the aisle trenches are being discharged into the large transverse trench, a similar walking beam advancing unit moves its contents to a point outside the barn where a suitable distrubition vehicle has been parked to collect it prior to the scattered return to the land.

Psychological Hazard

Although a problem like this sounds essentially simple it has several psychological complications which set it apart from the average fluid power job. In the first place one who has been selling for years cannot help but feel uneasy due to the very complete switch which places emphasis on collection. Then too, much of the observation must be conducted under unusual circumstances fraught with uncertainties. The old barn hands advise that there are clear and ample signals which always indicate areas of special hazard but anyone intent upon the real purpose of his mission remains understandably apprehensive. The knowledge that too much concentration on the hydraulic aspects of the problem can lead to a possible life-long dislike for dairy products and their source can prove distracting.

A cow barn may seem an unlikely place for the progressive supplier of fluid power equipment to look for additional outlets but experience and cost records show that an installation can be justified on the basis of labor savings.

Sell to Those Glass Houses

Speaking of possible markets for equipment there is another which has always been intriguing. Again it's away from the beaten

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The "Pressure-Sealing" V-Ring Packing

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Scientifically designed to make the pressure seal itself, BEL-VEE Rings expand toward the rod and stuffing box wall, on the power stroke or with increased pressure, to automatically form the pressure seal.

On the return stroke, or with pressure relaxed, BEL-VEE Rings contract from the rod for free movement with minimum friction.

BEL-VEE Rings are individually molded in a number of basic material combinations. Offered in sets for pressures to 6000 psi. for sealing reciprocating rods of pumps, engines, compressors, hydraulic equipment and valve stems—handling water, oil, solvents, steam, air and gas.

BEL-VEE Rings are made in practically every rod and stuffing box size.

THE BELMONT PACKING & RUBBER COMPANY

Butler & Sepviva Streets
Philadelphia 37, Pennsylvania

BELMONT

Circle 94 on Reader Service Card

Sonnet's NEW
Port Contour Cutter Produces
the NEW S.A.E.
Standard Hydraulic Boss
IN ONE PASS!

Cuts job time ⅔! This new special-purpose cutter has four flutes, with opposite flutes designed to perform the complete operation. A single pass of the cutter completes the chamfering, counterboring, radiusing, countersinking and spot facing operations necessary to produce the new S.A.E. straight tube hydraulic port boss. As a result, time required to complete the job is cut approximately ⅔!

Made from alloy-steel, the new tool is hardened for toughness and carbide tipped for long cutting life and smooth finish.

Write for sizes and prices today

Sonnet
TOOL AND MFG. CO.
576 No. Prairie Avenue, Hawthorne, California
Precision cutting tools in high speed steel and carbide

Ideas from A Sales Engineer

Continued

track but the need is there and to my knowledge unanswered with fluid power equipment. Have you ever taken the time to look around in a large green house? Growing under glass is not practical in all parts of the country but in our section it's big business.

All greenhouses are equipped with vents at or near the peak or ridge. These are long hinged frames with glass panels that are opened, closed or adjusted manually except in a few isolated cases. It is the constant job of the grower to attend to the adjustment of these vents. The problem is not too great during long intervals of relatively constant weather but it becomes quite a project during periods of changeable weather. Spring and fall with cold nights and hot days or even hot periods during the day with sudden chills due to clouds and wind gusts call for a multitude of vent adjustments in a short span of time. Bright warm summer days, when all vents are wide open, would seem to be no problem but where a sudden thunderstorm blows up, the vents must be left open as long as possible then closed quickly to avoid rain and wind damage. Merely closing the vents as the storm hits does not end the job. As soon as the storm blows over they must be reopened quickly to prevent "damping off" of whole areas of plants due to hot sun boiling down on a humid, non-ventilated enclosure. The problem is bad enough for the small operator with two or three houses to take care of but imagine the dashing around required to properly adjust the vents in the large establishments which cover acres of ground.

What an ideal place for some thermostatically controlled fluid power positioners, with central manual control for storms and high winds. Someday some one will do the necessary digging to completely define the problem and then come up with an answer. Then we can say again "I wish I'd thought of that". ▼▼▼

NOW.....YOU CAN DIVIDE HYDRAULIC FORCE WITHOUT SACRIFICING PERFORMANCE ON YOUR MAIN OPERATION!

Now, for the first time, manufacturers operating equipment hydraulically have practically full control of the division of hydraulic force. The New Products Flow Divider will divide hydraulic force without sacrificing performance of your main operation because of secondary flow as with ordinary flow dividers.

This means, for instance, that on fork trucks no power in lifting will be sacrificed to power steering.

The Flow Divider is also adjustable with a screw driver to restrict the flow of the secondary in any desired proportion when the primary is in operation.

The New Products Flow Divider is simple, easy to install. It operates on low circulation pressure and it eliminates extra pumps. It is compact in design and quiet in operation and it is built to precision standards of the finest materials.

A new folder is available that describes its operation in detail and sums up its advantages. You should have it. It will be gladly sent on request.

Performance graph of the New Products Flow Divider. The valve is illustrated to the right.

Pat. Pend.

NEW PRODUCTS CORPORATION
3636 Oakton Street Skokie, Illinois
Phone: ORchard 3-5873

Circle 44 on Reader Service Card

Announcing—

A NEW GRESEN VALVE With FLOAT Position

GRESEN HYDRAULICS

A Two Spool Directional Control With Float

FEATURES: Detent in Float Position—Self Centering From Power Positions—Fully Balanced—Relief Valve Has Replaceable Hardened Seat—Tripod Mounting Feet—Smooth Positive Throttling Action—Hardened and Chrome Plated Spools.

SPECIFICATIONS: Capacity 20 GPM (at 20 Ft/seconds)—Maximum Pressure 1500 PSI—Parallel Application—Shipping Weight 22-1/2 Lbs.

Write for literature

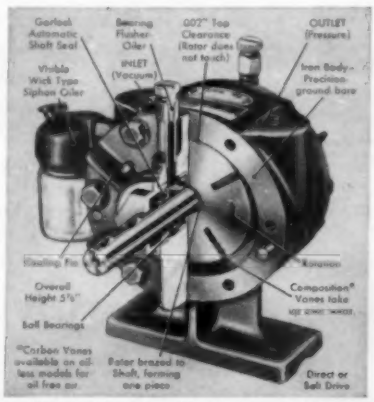
GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-27 Minneapolis 11, Minn.

INTEGRAL-MOTOR PUMPS
1/12 to 1/3 h.p. to 4 cfm.

LIGHT-DUTY PUMPS
V-belt, direct drive.

HEAVY-DUTY PUMPS
To 21 cfm, 28" vac. or 30 psi.


Gorlock Automatic Shaft Seal
Bearing Flusher-Oiler
.002" Top Clearance (Rotor does not touch)
OUTLET (Pressure)
Visible Wick Type Siphon Oiler
INLET (Vacuum)
Iron Body—Precision-ground bore
Composition* Vanes take
Overall Height 5⅞"
Ball Bearings
*Carbon Vanes available on oil-less models for oil free air
Rotor brazed to Shaft, forming one piece
Direct or Belt Drive

Quality and simplicity keep efficiency high on

GAST ROTARY VANE AIR PUMPS

This cutaway reveals why Gast Air Pumps are in demand for plant use and original equipment. Manufactured to high quality-precision standards, all models embody this efficient, simple rotary-vane design. Rotor is balanced; sliding vanes light in weight for minimum motion-energy-friction loss compared to other pumps. As vanes take up their own wear automatically, pump delivers full performance for years.

Write for "Application Ideas" booklet and catalog—mention capacity you need! **Gast Manufacturing Corp.** P. O. Box 117--D, Benton Harbor, Michigan.

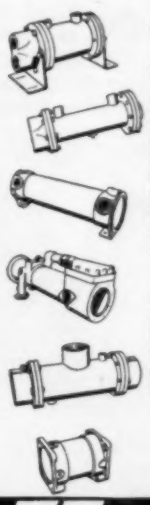
Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
- AIR MOTORS TO 4 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

See Our Catalog in Sweet's Product Design File

Circle 40 on Reader Service Card

Special Hydraulic Power Units rely on *Young* *Heat Exchangers*



Stock models or specially engineered Young Heat Exchangers are used for heating or cooling of process and hydraulic fluids, heat reclaiming, compressor cooling, and scores of other applications. Rating high on elimination of expansion strains, smoothness of flow, prevention of leakage, economy of initial cost and operation expense, Young Heat Exchangers can be depended upon *where quality counts.*

Two Young Heat Exchangers cool the oil for the above unit which supplies fluid power for a special machine used in the manufacture of plasterboard. The unit was designed and built by Hydro-Air Engineering, Inc., St. Louis.

Write Dept. 447-B for FREE Catalog

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Circle 118 on Reader Service Card

New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge

The O-M-engineered removable Rod Gland Cartridge is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

A *Rod Packing* — Vee type, non-adjustable, self-compensating, rod gland packing provides multiple lip seal with excellent pressure sensitivity and long life.

B *Rod Bearing* — Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

C *Cartridge "O" Ring Seal* — With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

D *Rod Wiper* — Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

E *Pilot* — O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders — conservatively rated at 2000 P.S.I. — are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are included in the new O-M Bulletin 105. Mail coupon for your FREE copy today

ORTMAN-MILLER MACHINE CO.
1143rd Street, Hammond, Ind.

☐ Have representative call ☐ Send Bulletin 105

Name_____ Position_____

Company_____

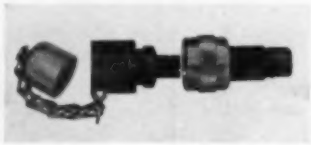
Address_____

City_____ Zone_____ State_____

New Products continued

QUICK-CONNECT COUPLING
. . . is self-sealing

Features: Turning the threaded female union coupling actuates two spring loaded pins to open or close the leakproof connection.



When coupling is disconnected, an attached dustcap protects the threads and keeps connection free from dirt and damage. Unit is rated at 5000 psi and made to government standards.

Wisconsin Hydraulic, Inc.
Milwaukee, Wis.
Circle 136 on Reader Service Card

HYDRAULIC TORQUE BOOSTER
. . . uses gerotor mechanism

Design: Small torque signal applied to the input shaft, through a servo valve and hydraulic motor, delivers a corresponding movement of output shaft, regardless of direction of rotation. Rotation is continuous at

speeds up to several hundred rpm. Method of using gerotor in torque generating element develops many times the torque normally produced in a mechanism this size.

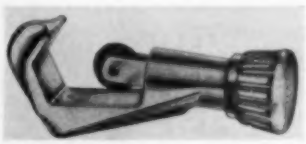
Gerotor: Outer ring is stationary and inner rotor rolls around inside the ring on a center which describes a circle. Gerotor becomes both a fluid displacement mechanism and a gear reduction. A 6 to 1 speed reduction is obtained with a 7-tooth ring and a 6-tooth rotor. Very high torque is developed at low output shaft speeds when used as a hydraulic motor. Pressure distribution is accomplished by a rotary distributor valve or sleeve connecting 7 radial holes in the body to either pressure or return in proper sequence. The 7 holes in the body connect to 7 displacement chambers, successively formed between the inner and outer gerotor members as the rotor turns with respect to the outer ring.

Char-Lynn Company
Minneapolis, Minn.
Circle 137 on Reader Service Card

NYLON TUBING TOOLS
. . . offer precision

Designation: 227-FP Cutting & 300-FP Flaring Tools

Features: Tube cutter is designed to make quick, clean, square cuts



without fracturing tubing. Cutting wheel is non-rotating and made of alloy tool steel. Cuts nylon or similar tubing ⅛ to ¾ inch O.D. Flaring tool makes 45-degree flares on $\frac{5}{16}$, ¼, $\frac{5}{16}$, ⅜, ½ and ⅝ inch O.D. nylon tubing. Because of resiliency of nylon, tubing is flared to a wide angle. When tube is removed from the tool, it springs back to the correct 45-degree angle flare. Tool has a die holder with sliding dies for clamping tubing, with a screw, operated by a bar handle, at one end for tightening.

The Imperial Brass Mfg. Co.
Chicago, Ill.
Circle 138 on Reader Service Card

STEP SWITCH
. . . is solenoid actuated

Designation: MT Series

Application: Heavy duty step switch for fluid power service simplifies circuits and often eliminates

Continued on page 108

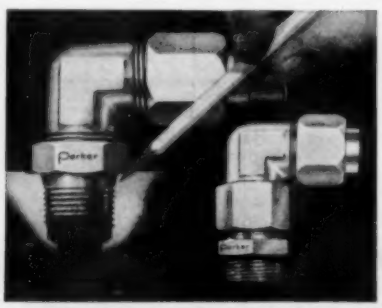
Be sure to see Parker for both tube and hose fittings!

Here, from one convenient source, you can get the most advanced hydraulic fittings available . . . both tube *and* hose. For example, new Parker *no-skive* Hoze-lok fittings require no stripping of rubber-covered hydraulic hose. They're faster, easier to use and *re-usable.*

Also, new Parker *straight-thread* tube fittings solve high-pressure hydraulic leakage problems resulting from tapered pipe threads. *Straight* threads are available on Triple-lok (the industrial standard flare tube fitting) and on Ferulok (flareless fitting for heavy steel tubing).

Parker
Hydraulic and fluid system components

***No-skive* Hoze-lok fittings** need no stripping of hose covers. Only two simple steps complete the make-up. Re-usable.



Straight-thread tube fittings provide leakproof, trouble-free connections. No overtightening. O-ring makes the seal.

TUBE & HOSE FITTINGS DIVISION
Section 422-A
The Parker Appliance Co.
17325 Euclid Ave., Cleveland 12, Ohio

☐ Please send *no-skive* Hoze-lok Bulletin No. 4402
☐ Straight-thread fittings Catalog No. 4301

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

New Products continued

the use of auxiliary relays and other electrical components. Unit can be used to provide a positive interlock between sequence operations on one or more machines.

Specifications: Switch carries contact ratings of 10 amperes. Rotary solenoid actuating coil operates directly on 115 volt, 60 cycle current without the use of rectifiers. Unit is available with one to 20 independent circuits. Basic mechanism has been used under extreme environmental conditions over a period of 20 years.

Eagle Signal Corporation
Moline, Ill.
Circle 139 on Reader Service Card

A LITTLE "FULFLO" VALVE does a big job on THE WORLD'S LARGEST BAND SAW AND FILER

built by The DoAll Co., Des Plaines, Ill. for the Air Force's "Heavy Press Program"

Operated by remote control from a suspended platform, this huge machine cuts intricate die cavities in die blanks weighing up to ten tons. Intended for the world's largest extrusion press (14,000 tons), these dies will shape the largest and longest structural aluminum extrusion ever produced. Jaws for the world's largest extrusion stretch-conditioner (3,000,000) are also cut on this Band Saw.

• FULFLO VALVES

By-Pass, Oil-Relief, Piston Type Hydraulic for machine tool hydraulic mechanism, oil-burning equipment, rams, presses and Diesel engines.

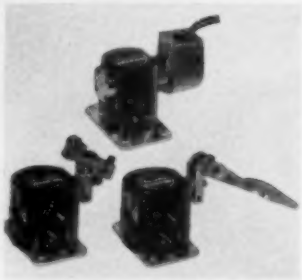
STANDARD OR FLANGE TYPES
for pressures from 0# to 500#

Write for personal copy,
FULFLO MECHANICAL DATA BOOK

THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

4-WAY AIR VALVES . . . for 5 to 150 psi

Features: Available as single solenoid, or for foot or cam operation. Single solenoid valves are of the



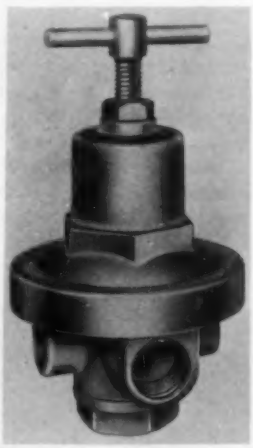
air-return principle with no springs used in their construction. All friction surfaces are hardened and permanently coated with a baked-on lubricant. Designed for operation from 5 to 150 psi. Solenoid valves will reciprocate 800 strokes per minute. Two speed controls are built-in to provide full control of the cylinder piston in both directions.

A. K. Allen Co.
Brooklyn, N. Y.
Circle 140 on Reader Service Card

PRESSURE REGULATOR . . . offers high capacity

Designation: HC

Features: Designed for high capacity pressure regulation of air and oil and to conserve space. Regulator



is ¼-inch pipe size, $2\frac{3}{8}$-inches diameter, $3\frac{3}{8}$-inches high and has a capacity many times that of larger units. With an inlet pressure of 200 psi, and a reduced pressure of 80 psi at no flow, the flow can be increased to 80 cfm of free air with a pressure drop of only 2 psi. A

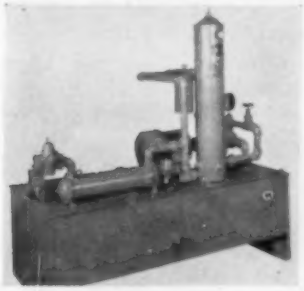
direct diaphragm operated valve is used instead of a pilot. Design improvement causes the valve to open wider as flow increases, maintaining the regulated pressure at the higher flows.

Generant Engineering Co.
Newark, N. J.

Circle 141 on Reader Service Card

PUMPING UNIT
. . . for pressure lubrication

Features: Designed to deliver 18 gpm at 50 psi. Oil viscosity is 1200 SSU at 100 degrees F and bypass



filtration is employed to remove foreign particles larger than 5 microns. Unit is equipped with 1018

Continued on next page

Circle 19 on Reader Service Card

NOW standardized . . .
PRECISION DRILLED
MANIFOLDS
and
Sub-Plates

MODEL
BHP-3002

Slash installation costs—Eliminate long cylinder lines—Give better cylinder action

Single feed manifold —shown with 4-way, flow and decelerating valves.

STANDARDIZED MANIFOLDS: Leak Proof, Solid Steel, Common tank, pressure and drain, All ports clearly marked, Mount near point of operation. These features give you lower cost installation and better performance.

SUB-PLATES: Side entering—All sizes to accommodate any standard hydraulic Valve.

SPECIAL DESIGNS: Our skilled craftsmen will design and manufacture Precision Drilled, Solid Steel, Leak Proof Manifolds to your specifications—Just send us a drawing of your circuit. We will give you a cost estimate. Write for catalog of standardized models.

BIRMINGHAM
Hydraulic Products Co.
14540 Schaefer Road
Detroit, Michigan
Phone BR. 3-8047

Control Gases to 10,000 P.S.I.

WITH VICTOR GAS-O-DOME REGULATORS

VICTOR'S LONG EXPERIENCE IN PIONEERING HIGH PRESSURE GAS REGULATION *is yours for the asking. For details, and complete data on Gas-O-Dome Regulators, see your VICTOR dealer or write us for catalog 341. Dealer inquiries invited.*

VICTOR EQUIPMENT COMPANY
Mfrs. of welding & cutting equipment, hardfacing rods, blasting nozzles; cobalt & tungsten castings.
844 FOLSOM ST. • SAN FRANCISCO 7 21

Gas pressure, not springs, control diaphragm motion to give you precise regulation of high-pressure gases at high or low flow rates. Can be remotely controlled if desired. Safety valve furnished on request. More than 55 stock models in the following series:

GAS-O-DOME SERIES	DELIVERY RANGE (p.s.i.)	SPECIAL FEATURES	GASES HANDLED
GD 30	0-2500	High Delivery Flow Rates. Accurate Valve Control.	Air, Argon, Helium, Hydrogen, Nitrogen, Oxygen —and others non-corrosive to bronze and stainless steel.
GD 31	0-3600		
GD 61B	0-2500	Excellent Capacity. Compact— 7 lb.— 4" x 6" x 6". —67° to +160° F. Range.	
GD 62B	0-3600		
GD 80	0-5000	Accurate Valve Control. —67° to +160° F. Range.	
GD 81	0-10000		
GD 10	0-500	Self-Relieving Pilot Regulator Control. High Flow Rates.	
SR 10	0-1000	High Pressure, Low Flow. Compact—4 lb. —2" x 6" x 6".	
SR 100	0-30 & 0-40	Corrosion Resistant.	Ammonia (wet or dry) Boron Trifluoride Chlorine (wet or dry) Hydrogen Sulfide, Hydrogen Chloride, Sulfur Dioxide—and other corrosive gases.

Circle 111 on Reader Service Card

Circle 109 on Reader Service Card

One leak or a thousand . . . if you have a similar frustrating experience in a metal-to-metal static sealing problem, United's Metallic O-Rings are the answer!

They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from –70 to 1800° F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and finishes, ⅜" to any size or configuration.

For free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department K-2.

UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1035
Division of United Aircraft Products, Inc.

Member of The National Fluid Power Association

ELIMINATE a PUMP

With A FLUID CONTROLS

Pick off a regulated flow from the main pump to operate an attachment, feed circuit, control system, power steering, or table lift.

- **Considerable savings in space, and money**
- **Long trouble-free service**
- **Available in ¼" thru 1" pipe sizes**

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

Manufacturers of Hydraulic Valves and Devices

Fluid Controls, inc.

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

New Products / continued

BTU/Min. heat exchanger and automatic controls to maintain constant temperature and prevent buildup of abnormally high pressure. For use where it is desired to install a self-contained, packaged lubricating system.

Cardwell Machine Co.
Richmond, Va.
Circle 142 on Reader Service Card

SOLENOID AIR VALVE
. . . controls to 100 psi

Designation: Electroflo

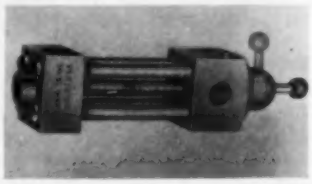
Specifications: Valve may be secured with a full ⅜-inch or ¾-inch orifice. Continuous duty solenoids

are available from 6 volts DC to 440 volts AC. Overall length of ⅜-inch model is 2-17/32 inches; the ¾-inch, 3-¾ inches. Inlet center to top dimension of the ⅜ size is 4-⅜ inches; the ¾ size, 5-1/32 inches. Coil diameter of either size is 2 inches.

Hays Manufacturing Company
Erie, Pa.
Circle 143 on Reader Service Card

FLOW INDICATOR
. . . is clearly visible

Designation: Sight Flow Indicator



Features: Unit is a combination header and Demi toggle valve for tight shut-off. Assembly is used to indicate leakage flows or any small flow requiring constant checking. Since the Demi valve toggles shut in one plane, open or closed posi-

tion is positively indicated by distinctively colored ball. A variation of design is used on purge systems, with a minute 200-to-1 rangeability needle valve being used for throttling. Flow range available is 0-2 SCFH. A variety of barstock materials can be specified.

George W. Dahl Company
Bristol, R. I.

Circle 144 on Reader Service Card

TUBE BENDER
. . . duplicates bends

Designation: Duplicating Bender

Features: Operating on compressed air, unit can be set up to duplicate from the template the making of any bend. Three ball and socket units permit a double backstop to be placed in any required position for locating one end of a tube to start a series of operations, and then locate the same tubing in the vicinity of a previous bend for completing the several bending steps required. Ball and socket units are clamped in desired settings by air actuated diaphragms that clamp the ball element of each unit. Template enables checking degree and location of bend, distance and angles between bends. When tube has been bent to the requirement of the template, all subsequent tubes are bent without the need for checking each individual bend.

Wallace Supplies Mfg. Co.
Chicago, Ill.

Circle 145 on Reader Service Card

ENCLOSED LIMIT SWITCH
. . . provides versatility

Designation: Licon (R) Type 30
Features: Enclosed precision limit switch has versatility due to interchanging components, 3 actuators and 3 housings forming 16 types of switches. Die-cast aluminum housings provide a rugged enclosure, adequate wiring space and a ½"-14 internal tap conduit hub. Actuators include plunger, roller arm and roller plunger types. Installed with #10 through bolts or with an alternate bottom mounting plate supplied with every switch. Sealed model is oil, dust and water tight.

Operation: Roller arm actuator has a micrometer screw adjustment which moves the arm through a wide arc in setting the trip point. When switch trips, a slight additional turn is given to allow for over-travel, then the locknut is tightened. This method eliminates trial-and-error, prevents borderline operation and offers an unlimited number of trip positions. Roller

Continued on next page

LOOK TO LOGAN

Illustrated
Logansquare Cylinder

LOGANSQUARE CYLINDERS ARE DESIGNED TO GIVE YOU PEAK PERFORMANCE IN EITHER AIR OR OIL SERVICE

MEMBER: *National Machine Tool Builders' Assn.; National Fluid Power Assn.*

Designed for low and medium pressures in either air or oil service, Logansquare cylinders meet a wide range of mounting applications and power movement needs. Regardless of your production requirements, Logan has the air or hydraulic components to serve you best.

SEND FOR FREE "LOGAN CALCULATOR"

LOGANSPORT MACHINE CO., INC.
832 CENTER AVE., LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ Facts of Life
- ☐ 100-1 Air Cyls.
- ☐ 100-2 Mill-Type Air Cylinders
- ☐ 100-3 Air-Draulic Cylinders
- ☐ 100-4 Air Valves
- ☐ 100-5 Logansquare Cyls.
- ☐ 100-5-1 Ultramation Cyls.
- ☐ 51 Presses
- ☐ 62 Sure-Flow Pumps
- ☐ 200-1 Hyd. Power Units
- ☐ 200-2 Rotocast Hyd. Cyls.
- ☐ 200-3 750 Series Hyd. Cyls.
- ☐ 200-4 and 200-7 Hyd. Valves
- ☐ 200-6 Super-Matic Cyls.
- ☐ 70-1 Chucks
- ☐ ABC Booklet
- ☐ Circuit Rider

TO:
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____

New Products continued

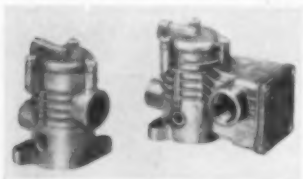
arm can be turned to take positive and direct actuation from any direction. Roller plunger type actuator is adjustable through 360 degrees for actuation from any direction. Plunger actuator type switch has .002 movement differential and ½-inch overtravel.

Licon Switch Division
Illinois Tool Works
Chicago, Ill.

Circle 146 on Reader Service Card

SOLENOID PILOT VALVES ... for air and fluid service

Designation: Valvair Pilot Valves



Features: Valves are designed for control of remote pilot operated valves or direct control of small cylinders and similar devices. Solenoid enclosure is dust and moisture proof. Both plunger and spring, the only moving parts, are of stainless steel. Air passing around the plunger cleans and lubricates it and cools the coil.

Specifications: Capacities range up to 23.8 cfm air and 3.8 gpm hydraulic with control of 600 cycles per minute. Valves are available with or without integral junction box for 6-inch taped pigtail leads. Solenoid and junction box covers are fitted with captive fasteners to prevent loss. Removal of solenoid cover renders valve inoperative. Valves can be supplied for direct pipe connection, with sub-base, or drilled for mounting on manifold. Solenoid coils are supplied for 3 to 300 volts DC, 6 to 550 volts AC and 25 to 60 cycles.

Valvair Corporation
Akron, Ohio

Circle 147 on Reader Service Card

AIR LINE LUBRICATOR ... tees into any line

Designation: Model HP31

Features: Lubricator introduces a controlled oil fog into air stream at working pressures up to 200 psi.

Unit is small, compact and has conveniently located mounting brackets designed to tee into any high pressure air line. Reservoir capacity of one quart eliminates necessity of continuous filling.

Design: Line pressure is introduced through a valve into the oil reservoir, pressurizing the oil. At this point, air line and reservoir pres-

PNEUMATICS SHEFFER HYDRAULICS

AIR CYLINDERS

C10 Series

- 150 psi Air—To 500 psi Hydraulic
- Semi-Steel Cast Heads
- Meets or Exceeds J.I.C.
- 10 Bore Sizes—1½-10.
- Most Effective Cushions
- Hard Chrome Plated Rod—Wrench Flats

Write for Bulletin #157

THE SHEFFER CORP.

CINCINNATI 16, OHIO

MOST COMPLETE LINE OF CYLINDERS IN THE INDUSTRY

SOME TERRITORIES OPEN

Circle 89 on Reader Service Card

TRU-O-SEAL TEFLON SEAL

STOPS PIPE THREAD LEAKS

PAT. PENDING

Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

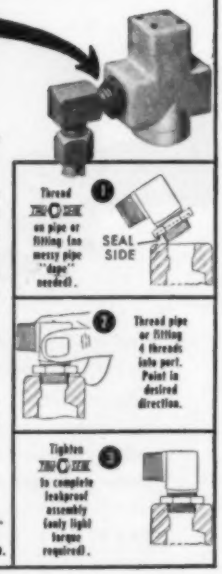
$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ¾", ten ½" pipe thread TRU-O-SEAL Fittings.

$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.

Send order to

TRU-O-SEAL DIVISION
Flick Reedy Corporation
2008 N. Hawthorne • Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Circle 105 on Reader Service Card

sures are equal. When operators start air tools, or any air actuated mechanism, air line pressure momentarily drops. At this moment back pressure in the reservoir forces a fog of oil into the air line. Fog is suspended in the air and provides perfect lubrication.

The Rucker Company
Oakland, Calif.

Circle 148 on Reader Service Card

HYDRAULIC PUMP . . . for power steering

Designation: Model VT-27

Design: Vane type pump has integral regenerative supercharged system permitting pump operation to speeds of 7150 rpm. Rotating group is interchangeable, giving dual capacity. Pump can use either 4 or 5 gpm insert type ring. Capacity is rated at 1200 rpm. Supplemental flow control feature is integral with pump housing, providing a flat delivery curve through normal operating speeds with diminished delivery at high speeds.

Features: Unit is belt-driven and has a 27 cubic inch external reservoir mounted on top of the pump housing. Special brackets permit adaptation to a wide variety of engine installations. Mounting bracket provides for adjustment of belt tension.

Specifications: Pump is compact and light weight. Pressure lubricated sleeve type bearing is used in

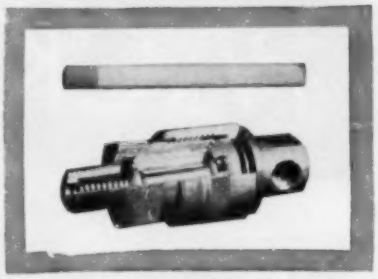
place of ball bearing. Unit measures 3-7/16 inches housing length and 6-⅜ inches over the shaft. Pressure connection is SAE inverted flare-type fitting for ⅜-inch diameter hose. Return connection is for clamp-on hose.

Vickers Incorporated
Detroit, Mich.

Circle 149 on Reader Service Card

Circle 52 on Reader Service Card

NOW TRY HUSCO
Hydraulic Control-Engineering for Improved Performance, —Space and Cost-Saving



Every Husco Hydraulic Control is custom-engineered for your equipment! We have no "standard" models to push. But our successful experience with hundreds of difficult control problems—confirmed by case histories—promises you the *right* control for your needs . . . Control Valves, Check Valves, Reciprocating Valves, Hydraulic Cylinders, Pumps, Power Units—they're all engineered to your specific equipment demands for size, capacity, performance.
Check HUSCO *first* for precision engineered Hydraulic Units. You'll save time, money and worry. Write for details.

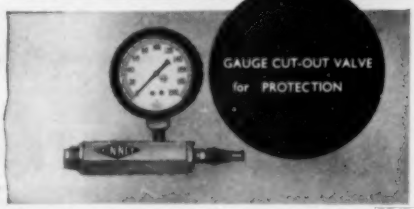
HUSCO **HYDRAULIC UNIT SPECIALTIES CO.**
Pumps • Valves • Cylinders
Waukesha, Wis.

MODERN HYDRAULICS
demand
MODERN ANCILLARIES

Greer-Mercier Accumulators, offering power intensification, pressure storage, shock absorption, volume compensation, and surge elimination, are available in a variety of sizes to suit any modern hydraulic application.

Finney Sensitive Pressure Switches provide a pressure range of 400—4,000 P.S.I. with pressure differential adjustable between 100—500P.S.I. For wide differentials two micro-switches are fitted.

This Cut-Out Valve automatically isolates recording instruments from pressure surges and offers complete protection within its pressure range of 50 to 4,000 P.S.I.

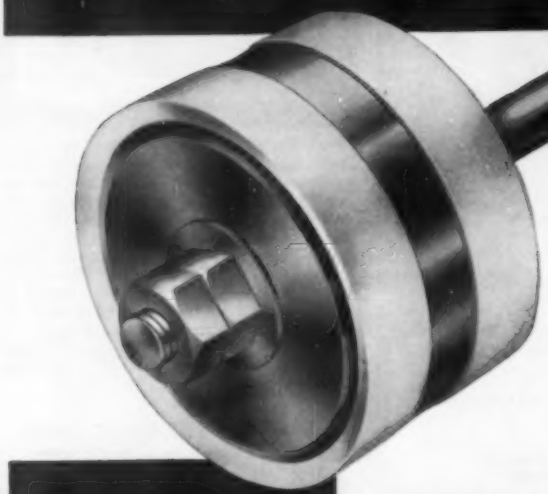


FAWCETT FINNEY LIMITED

FAWCETT-FINNEY LIMITED
BERKLEY STREET BIRMINGHAM 1
Telephone: MIDLAND 3795 (3 lines) Cables: FINHYD BIRMINGHAM
A METAL INDUSTRIES GROUP COMPANY

PF/5

HYDRAULIC PACKINGS



TEFLON

"Chemiseal" hydraulic packings—made of duPont TEFLON*—have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Unsurpassed in anti-friction properties, tough, resilient, non-flammable, long wearing, chemically impervious. Service temperature range from —110°F to +500°F.

All Standard Packing Forms shown at left, plus Chemiseal Back-up Rings made in spiral, solid and split ring types—and the new Chemiseal Slotted O-Rings (patented) that provide greater cross-sectional deformability, thermal expansion compensation and automatic pressure sealing action.

Write for further information and samples.

*duPont Trademark.

UNITED STATES GASKET CO.

CAMDEN 1, NEW JERSEY

Useful Literature / continued

SHUT-OFF VALVES . . . motor-operated, designed for high pressure control functions, handle hydraulic fluids, high pressure pneumatics, liquid oxygen, rocket fuels and oxidizers and jet fuels. Two-page illustrated bulletin 23 issued by Hydromatics, Inc., provides detailed description of unique valve design giving zero pressure drop and zero leakage under extreme temperature and environmental conditions. Complete dimensions and operating specifications are given in chart form.

Circle 188 on Reader Service Card

TEFLON HOSE . . . and other hose assemblies and fittings are covered in Aeroquip Corporation's Aircraft Catalog No. 101. Included in the catalog is important engineering data on low, medium and high pressure assemblies with detachable, reusable fittings and self-sealing couplings, flange fittings and elbow assemblies. Teflon hose with super gem fittings for medium pressure aircraft applications has been added to the line. Catalog furnishes detailed reference charts for quick conversion of part numbers to various AN and other military designations. Complete assembly and installation instructions are furnished.

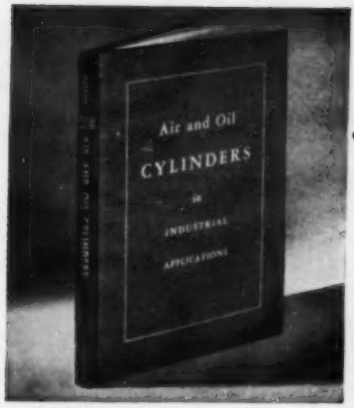
Circle 189 on Reader Service Card

A-C MOTORS . . . for specific applications, are shown in Reliance Electric and Engineering Company's 12-page Motor Selector bulletin B-2103-1. Booklet gives full information on how to select A-C motors for specific applications. Comprehensive selection data is included on speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables, and dimension charts and mechanical modifications for frame sizes.

Circle 190 on Reader Service Card

TEMPERATURE REGULATORS . . . for hydraulic service, featuring balanced construction and vapor pressure operation, are detailed in bulletin TR-57 offered by Atlas Valve Company. Regulators are suitable for controlling initial temperatures from 60 to 240 degrees F in increments of 40 degrees. Accuracy range is ±3 to 5 degrees F.

Continued on page 116



AIR & OIL CYLINDERS

Elmer Heiser has written this valuable cylinder handbook which tells about types, cushions, how to order, proper porting, correct sizing, packings, and efficient installation methods.

It's full of application ideas.

PRICE $5.00

The Industrial Publishing Corporation

812 Huron Road • Cleveland 15, Ohio

Circle 78 on Reader Service Card

★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications

Pneu-Trol Speed Control Valves, are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.

1083 N. KEATING AVENUE • CHICAGO 51, ILL.

it's NEW!

5/8 INCH BORE

AIR-OIL CYLINDER

If you've been using 1" or larger bore cylinders for those applications in which you wanted the "smallest" bore, here are some of the benefits you'll derive from the new AIROYAL ⅝" bore cylinder: more compact size; reduced thrust from a given pressure; lower piston and rod inertia; increased velocity from a given flow input.

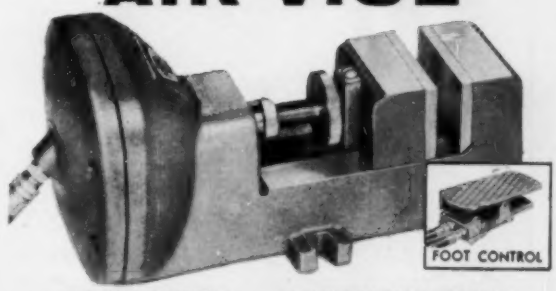
Cylinders are available single and double acting in all mounting styles. And you'll appreciate the low price—only $28.00 list for pressures to 750 PSI, $32.00 for pressures to 1500 PSI.

MANUFACTURED BY

THE AIROYAL CO

1990 SPRINGFIELD AVENUE
MAPLEWOOD, N. J.
REPRESENTATIVES IN PRINCIPAL CITIES

Speedy AIR VISE



HIGH SPEED • POWERFUL GRIP

New, improved model speeds up all repeat operations—*milling, drilling, tapping, punching, bending, riveting.* Both hands left free to produce more! Light squeeze to 2250 pounds pressure! Extra thick jaws for attaching jigs. Jaws open to 3-inches; 1/16" to 5/8" maximum travel. Complete with foot control, air hose and fittings..... **$44.00**

SPEEDY 1-TON AIR PRESS

Does the work of expensive presses! Power factor 15 times air line pressure. 5-inch throat; Ram 0 to 5"; stroke ⅜"; table 5" x 5". Operated by foot or fingertip controls. **$85.00**

Order from Your Supplier or Write for Air Tool Catalog

W. R. BROWN CORP., 2655 N. Normandy Ave., Chicago 35

AIR TOOLS • AIR VISES • AIR REGULATORS • FILTERS • COMPRESSORS

Circle 5 on Reader Service Card

Circle 20 on Reader Service Card

5th Annual Competition

1957 FLUID POWER PRIZE PAPER CONTEST

for Articles About:

Pneumatic and Hydraulic Systems and Components

DESIGN • APPLICATION • MAINTENANCE

First Prize $500

Second Prize $300

Third Prize $200

4th to 7th Prizes, each $50

All prize papers will be published in APPLIED HYDRAULICS Magazine. Papers receiving honorable mention awards will also be published during 1958 and paid for at regular rates.

CONTEST CLOSES JULY 1, 1957

SPONSORED BY **APPLIED HYDRAULICS**

An Industrial Publishing Corp. Magazine

TO RECEIVE A CONTEST RULES BOOKLET
CIRCLE 320 ON READER SERVICE CARD

Useful Literature / continued

Available in single or double seat design, in bronze or iron with stainless steel trim, in sizes from ½ to 4 inches. Units withstand inlet pressures up to 300 psi.

Circle 191 on Reader Service Card

WINDOW UNITS . . . for various applications in hydraulic service, are illustrated and described in bulletin 4D issued by Bijur Lubricating Corporation. Three different types of circular window units are discussed for observing liquid level or flow, or internal parts. Specifications and design data are presented in separate tables.

Circle 192 on Reader Service Card

FLUID SYSTEM SPECIALTIES . . . are illustrated and described in catalog 4395 issued by Parker Appliance Company's Tube & Hose Fittings Division. Items covered include clips for support of tube lines, dual heat transfer coil for cooling applications, pressure snubber for protection of gages, and manifold valve to simplify draft gage line blow out.

Circle 193 on Reader Service Card

SILICONE LUBRICANTS . . . of all types are available in quantity from Dow Corning Corporation. Brochure 6-101 describes properties and performance of various silicone oils, greases and compounds. Many typical applications are listed and illustrated, and helpful technical data is given in easy-to-understand tables and graphs. Special attention is given to high speed, high temperature ball bearing problems.

Circle 194 on Reader Service Card

"TOTAL PROTECTION MOTORS . . . are graphically detailed in bulletin B-2501 available from Reliance Electric and Engineering Company. Cutaway views of the new A-C, totally protected motors and components clearly show how they are designed for applications which formerly required drip-proof or splash-proof motors. Units operate within a maximum temperature rise of only 40 degrees C.

Circle 195 on Reader Service Card

PIPE, TUBING & WELDING FITTINGS . . . produced from

Croloy steel, are specified in bulletin 152-A offered by The Babcock & Wilcox Company's Tubular Products Division. Condensed data is given on mechanical properties, creep strength, physical properties, hot and cold bending, welding, heat treatment and working pressure. Detailed information is given in convenient tabular form.

Circle 196 on Reader Service Card

FLEXIBLE COUPLINGS . . . employing preloaded rubber biscuits as the flexible medium, are fully described in 24-page catalog released by Morse Chain Company. Complete dimensions and specifications are given on standard, double and radial type couplings, with additional data on coupling driveshafts. Torsional deflection charts and instructions for use explain the method of coupling selection in controlling torsional vibration of a system.

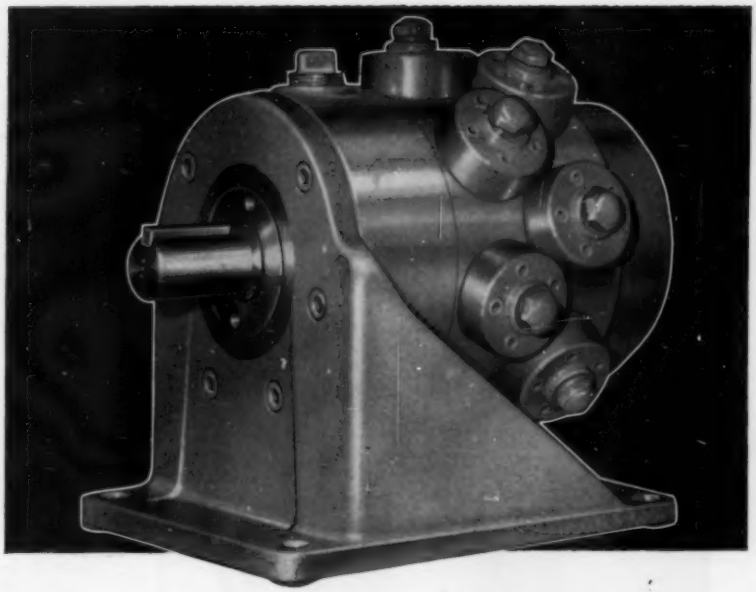
Circle 197 on Reader Service Card

CLASS 3A THREADS . . . In a new booklet on threads, Standard Pressed Steel Company warns against the danger of accepting misfits and describes how it can be avoided. This 16-page booklet on thread fit and gaging should be interesting reading for anyone in the fluid power industry who wants to know whether his screw threads are actually within tolerance. Both theory and practice are illustrated, including basic principles of measuring high and low limits of pitch diameter tolerance. Also given are tips on gaging techniques, and a method for setting gages that is more accurate than the one generally used. Reference data includes pitch diameter tolerances.

Circle 198 on Reader Service Card

AIR and OIL CYLINDERS . . . for heavy duty service, are described in catalog 1-HD issued by Modernair Corporation. The new hydraulic checking cylinder listed should be of special interest to hydraulic engineers. These units are designed as accessories for air cylinders to smooth out stroke variations due to compressibility of air under irregular loads. Units provide smooth, controlled stroke speed for tool or work piece feeds. Complete technical information is given on the new heavy duty line, including complete parts lists.

Circle 199 on Reader Service Card



for HIGH HORSEPOWER— HIGH PRESSURE service

This Series "C" SECO heavy duty pump is a rugged, revolutionary answer to high pressure, high horsepower requirements. It opens up new horizons in the use of oil hydraulic power.

Pressure is developed *within hollow pistons*—making it possible to generate pressures up to 10,000 PSI without loss of mechanical efficiency. Each piston assembly is completely surrounded by high pressure lubrication and literally *floats* in a hydrostatic film of oil during its pressure stroke. A specially designed oversize Timken bearing assembly insures minimum friction and maximum area of contact at points of piston actuation. *Fluid timed* ball check valves insure quiet and efficient operation at all pressures.

Series "C" SECO pumps are at present made in 2 models, with the following characteristics:

MODEL		C-11	C-5
MAXIMUM PRESSURE. SPOT RATING.....	PSI	5,000	10,000
MAXIMUM PRESSURE. CONTINUOUS RATING	PSI	4,000	6,000
DELIVERY AT MAXIMUM PRESSURE.....	GPM	10	5
SPEED	RPM	1170	1170
POWER INPUT AT MAXIMUM PRESSURE....	H.P.	35	38

If you are interested in high horsepower, high pressure hydraulic power, you should have complete information on these heavy-duty pumps. Use the Reader's Service Card.

SECO

SERIES "C" "HOLLOW PISTON" PUMPS

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

Circle 91 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Kenneth W. Donle
Tube Reducing Corp.

John P. Anderson
Pacific Division
Bendix Aviation Corp.

Conrad Hohmann
Vickers Incorporated

Kenneth W. Donle was appointed manager of product engineering for **Tube Reducing Corporation,** Wallington, N. J.

Charles E. Miller was made head of engineering services at **Bendix Aviation Corporation's Pacific Division,** North Hollywood, California. Miller was active in the early development of electro mechanical actuators and has been with Bendix-Pacific for 15 years. **John P. Anderson** was appointed project engineer, hydraulic servo valve engineering group.

Frank T. Goll was promoted to sales manager by **C. A. Norgren Co.,** Englewood Colorado. Formerly with Parke Davis Company in Denver, Goll joined Norgren in 1953.

Lewis M. Crowe Company, Atlanta, Georgia, was appointed sales representative for **Conoflow Corporation** in Georgia and eastern Tennessee. **Lewis M. Crowe, Jr.,** is president of Crowe with offices in Atlanta, Georgia.

New national service director of **Robertshaw-Fulton Controls Company** is **A. C. Hansen,** formerly with Consolidated Vultee at Downey, California.

Vickers Incorporated, Detroit, named **Conrad Hohmann** assistant chief engineer, special airborne devices, and **Gordon E. Stauffer** application engineer.

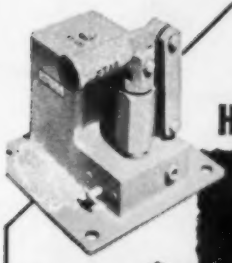
Twin Disc Company, Racine, Wisconsin has announced these promotions: **Edward C. Yokel** chief engineer and **George R. Aschauer,** assistant chief engineer of the general products division in Racine; **James B. Black** chief engineer and **Evert L. Venstrom, Marvin W. Dundore** and **Conrad R. Hilpert** assistant chief engineers in the Rockford hydraulic division.

Parker Appliance Company, Cleveland, Ohio, announced appointment of two new distributors: **Industrial Gasket & Packing Co., Inc.,** 801 South Walker Street, Oklahoma City, Oklahoma, **Charles J. Donavan,** president; and **Standard Brass & Manufacturing Company,** 4701 Palmetto Street, New Orleans, Louisiana, **J. R. Cartullo,** manager. **William E. Swan** has joined Parker as sales engineer covering Cincinnati, Dayton, Columbus, southern Ohio, Indiana and Kentucky. Swan succeeded **A N. Aiman,** transferred to Detroit. Another Parker distributor, **Haskel Engineering & Supply Co.,** moved to larger facilities at 225-11th Street, San Francisco, Calif.

Enoch While was named works manager at **Allis-Chalmers Norwood, Ohio Works,** succeeding **J. F. Costigan,** recently appointed assistant director of manufacturing, Industries Group. **R. C. Lathrop** became chief inspector and **C. E. Wikoff** assistant chief inspector.

Continued on page 120

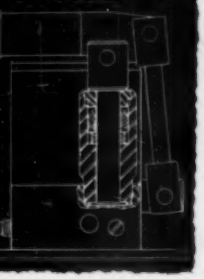
Circle 98 on Reader Service Card



STAR
SINGLE PISTON
HYDRAULIC PUMP

LOOK INSIDE—

SEE WHAT YOU'RE BUYING



- Spring loaded multiple chevron piston packings for lifelong service.
- All pistons chromium-plated to guard against abrasions.
- SAFETY BY-PASS VALVE to prevent overload dangers.
- Gauge opening.
- 60 cu. in. reservoir or smaller or larger to specifications.
- ½", ¾" or 1" pistons with 1½" stroke.
- 24" or 30" levers, as desired.

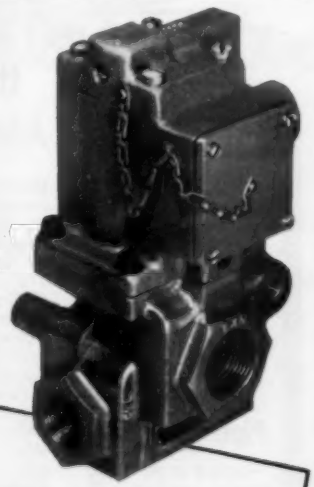
Ask for catalog #555. Special engineering counsel cheerfully submitted on request.

Representative areas available.

STAR JACK CO., INC.
420 LEXINGTON AVENUE, NEW YORK 17
PLANT: RIVER GROVE, ILLINOIS

J.I.C.
IN-LINE
3-WAY
SOLENOID
VALVES

$\frac{1}{4}$ · $\frac{3}{8}$ · $\frac{1}{2}$ · $\frac{3}{4}$ · 1 · $1\frac{1}{4}$

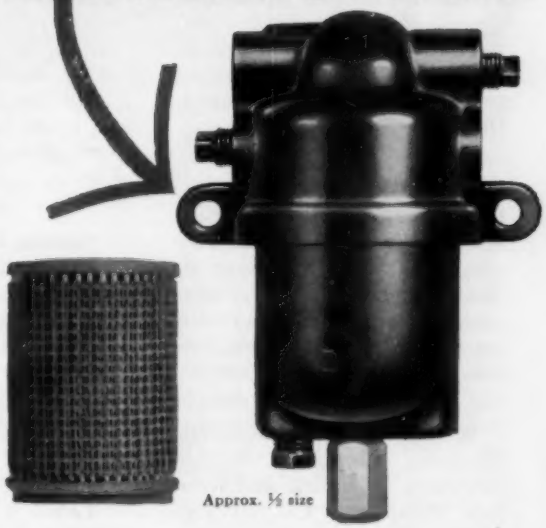


- NORMALLY CLOSED OR OPEN
- CONTINUOUS DUTY SOLENOIDS
- MOST A C & D C VOLTAGES

Write for Bulletin—Prices

COMPLETE LINE OF
Air Control Values by
AUTOMATIC VALVE CO.
27415 GRAND RIVER AVE • FARMINGTON, MICH.

NOW—AN ENTIRELY NEW *Bendix-Skinner* HYDRAULIC OIL FILTER

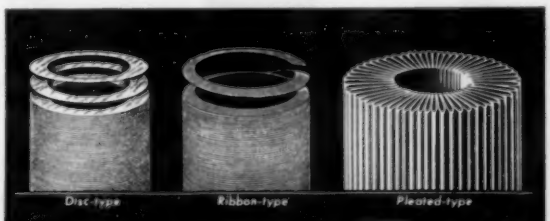


Approx. ½ size

OFFERING YOU FINER FILTRATION AT LOWER COST!

Here's everything you've wanted in a filter, including a built-in bypass—and all at a price equivalent to only six quarts of hydraulic oil! Yes, this newest addition to the Bendix-Skinner* line is truly the last word in efficient, yet economical, filtration. Its sturdy aluminum die cast construction assures long service—trouble-free, because it is available with either cleanable "ribbon" type elements for 40-micron filtration, replaceable "pleated" type for 10-micron filtration, or "disc" type, cleanable in 5 or ½ microns. Two ¼-inch N.P.T. inlets and two ¼-inch N.P.T. outlets make installation quick and easy. Operating pressure—100 p.s.i. Complete flow rate-pressure drop data on request.

*TRADE-MARK



BENDIX-SKINNER DIVISION OF
P.O. BOX 135, ROYAL OAK, MICHIGAN
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

ORIGINATOR OF **MICRONIC** FILTRATION

Post Scripts of Industry
continued

New sales engineers for **Adel Precision Products Division** of General Metals Corporation are: **Bernard P. Moser** and **Lee A. Doble**—Burbank, California plant; **R. E. Wolfe**—Dayton, Ohio office.

Heli-Coil Corporation, Danbury, Connecticut, appointed four sales executives: **John E. Fasano,** sales manager; **Bayeux B. Morgan, Jr.,** assistant sales manager; **Robert H. Kane,** advertising manager; **J. Laurence Sutton,** manager of customer service.

W. S. Nott Co., Minneapolis, Minnesota, was named exclusive distributor for **Plastic and Rubber Products Co.** of Los Angeles. Territory will include a five-state area.

Celanese Corporation of America's Chemical Division has opened two new sales offices. **Joseph N. Mamola** is manager of the Detroit office, 2842 West Grand Blvd., and **H. B. Bartley, Jr.** heads the Wilmington, Delaware office, 1035 F Philadelphia Pike.

George L. Nankervis Company now occupies its new multi-million dollar facility at 15300 Fullerton, Detroit, Mich. Designed to accommodate its own manufacturing operations and those of its subsidiary, Commercial Research Division, it is located on a 5-acre site.

Leach Corporation's Pressure Switch Division named **Gene H. White** sales manager.

H. B. Bartley, Jr.
Chemical Division
Celanese Corporation of America

Joseph N. Mamola
Chemical Division
Celanese Corporation of America

INVITING HOSE TROUBLE? TWIST STRAINS LURK UNSEEN

Check now for twist motions as well as bending. Remember under twist strain half the wire braid carries all the load.

Mayson Hose Swivels are quietly keeping equipment in steady operation.

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

Circle 63 on Reader Service Card

3000 psi won't get by the threads of Allen ○ Dryseals!

ALLEN 'TRU-ROUND' Dryseal Pipe Plugs

formed from special analysis ALLENOY steels.

Sold only through leading industrial distributors—specify genuine Allen Dryseal Pipe Plugs.

standard sizes from 1/16" to 1-1/4"

Here's the dependable, metal-to-metal seal you need for hydraulic systems . . . for transmission, control, and automated mechanisms where pressures run high. The N.P.T.F. threads of Allen ○ Dryseal Pipe Plugs are smooth, burnished, and burr-free — do their job without any help from sealing compounds. Allen's unique "pressur-forming" process assures the highest degree of precision threading and dimensional accuracy. What's more, Allen ○ Dryseals are precisely round at root, pitch and crest, with taper held to extremely close tolerances.

Allen engineers will gladly help you to harness your hydraulic pressures. Just write.

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

Circle 7 on Reader Service Card

E. L. Holbrook has become sales manager of **Westinghouse Air Brake Company's Industrial Products Division.** Holbrook has been with Westinghouse since 1929.

A. W. Cash Company, and its subsidiary **Cash Standard Stacon Corp.,** both of Decatur, Illinois, announced appointment of seven new representatives: **E. C. Cooley,** 1186 Folsom St., San Francisco, Calif.—San Francisco and northern California; **Gay Sales Company Associates,** 420 Sul Ross St., P.O. Box 13232, Houston, Texas—southeast Texas; **Lytle Engineering Specialties Ltd.,** 360 Notre Dame St., W., Montreal, Quebec, Canada—Montreal area; **McGinnis-Hill Co.,** 4809 Clinton Highway, Knoxville, Tenn.—east Tennessee and southwest Kentucky; **Noel Moffitt Co., Ltd.,** 203 Church St., Toronto, Ontario, Canada—Ontario area; **North-Monsen Co.,** P.O. Box 174, Salt Lake City 10, Utah—Utah and north and east Nevada; **Richard S. Dawson Co.,** 333 Glendale Blvd., Los Angeles, Calif.—southern California and southwest Nevada.

New home of **Ledeen, Inc.** at Gilman Road and Garvey Boulevard, El Monte, California. Plant houses Ledeen's offices and manufacturing facilities and also serves as headquarters for **Engineering Products Company,** a subsidiary of Ledeen. Building covers approximately 30,000 square feet.

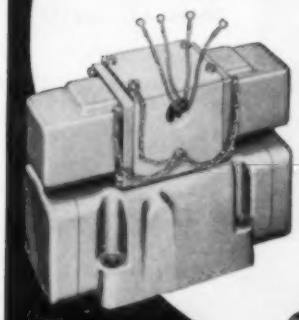
Rodney F. Plimpton has been named assistant to general manager by **Electro Dynamic Division of General Dynamics Corporation** in Bayonne. **Edward A. Troxel** is the new purchasing agent.

Parker Appliance Company has announced these appointments: **Staver Hydraulics Company,** 397 Pennsylvania Avenue, Waverly, New York as distributor; **Frank J. Opatrny** assistant sales manager for the Rubber Products Division, Cleveland, Ohio; and **William G. Webster** chief engineer for the Cleveland Division of Parker Aircraft Co., Los Angeles.

Continued on next page

Look to Logan

Illustrated Logan Sequence Valve



Illustrated Logan Piggy-Back Hydraulic Control Valve

Illustrated Logan Flow Control Valve

HYDRAULIC VALVES TO MEET YOUR TOUGHEST PRODUCTION REQUIREMENT

For many years the name Logan has been recognized as the symbol of quality, dependability. In every industrial center throughout America today, you'll find Logan hydraulic control valves on the job, meeting the toughest requirements. Let Logan engineers help you design your circuits to do a more effective production job.

MEMBER: *National Machine Tool Builders' Assn.; National Fluid Power Assn.*

LOGANSPORT MACHINE CO., INC.
832 CENTER AVE., LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ Facts of Life
- ☐ 100-1 Air Cyls.
- ☐ 100-2 Mill-Type Air Cylinders
- ☐ 100-3 Air-Draulic Cylinders
- ☐ 100-4 Air Valves
- ☐ 100-5 Logan-square Cyls.
- ☐ 100-5-1 Ultra-mation Cyls.
- ☐ 51 Presses
- ☐ 62 Sure-Flow Pumps
- ☐ 200-1 Hyd. Power Units
- ☐ 200-2 Rotocast Hyd. Cyls.
- ☐ 200-3 750 Series Hyd. Cyls.
- ☐ 200-4 and 200-7 Hyd. Valves
- ☐ 200-6 Super-Matic Cyls.
- ☐ 70-1 Chucks
- ☐ ABC Booklet
- ☐ Circuit Rider

TO:
NAME _____ TITLE _____
COMPANY _____
ADDRESS _____

SEND FOR FREE LOGAN CALCULATOR

Here's the SCHROEDER 3 way maintenance control system for IMPROVED HYDRAULIC OPERATION

1 *REDUCE the need for repair—*

Schroeder Hydraulic Filter Buggy

Removes troublesome dirt before it can gum up your hydraulic system. Saves oil, cuts pump and system repair costs.

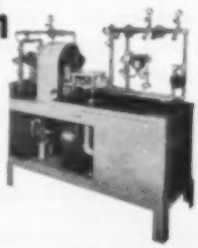
2 *LOCATE trouble at the machine—*

Schroeder Portable Hydraulic Circuit Tester

Does away with time-consuming hunting by quickly pinpointing the trouble spot before removing any component from the machine.

3 *TEST to prove repair—*

Schroeder Hydraulic Test Bench



Removes all guesswork—now you can be sure of the condition of each hydraulic component before it is returned to the machine.

For a smoother flowing hydraulic system use the Schroeder 3 way maintenance control system.

SCHROEDER BROTHERS CORPORATION

NICHOL AVE.
McKEES ROCKS, PA. SPaulding 1-4810
HYDRAULIC, ELECTRIC & PNEUMATIC EQUIPMENT

Post Scripts of Industry continued

Summerill Tubing Division of **Columbia Steel & Shafting Company,** Pittsburgh, has announced the appointment of **Van D. Clothier, Inc.** as exclusive west coast sales representative. Clothier will handle direct mill sales in California, Oregon, and Washington.

Gladden Products Corporation, Glendale, California, announced appointment of **Al Nadeau** as chief sales engineer of **Gladden Aircraft Products Corporation.**

Greer Hydraulics, Inc., Jamaica, N. Y., has a new central sales administration for servicing customer requirements, and a regional sales organization, headed by area managers. **Leonard H. Seeman** was made assistant general sales manager.

Flexonics Corporation, Maywood, Illinois, announced acquisition of **Flex-O-Tube Division of Meridan Corporation,** Inkster, Michigan. Flex-O-Tube will continue normal operation as a division of Flexonics. No personnel changes are contemplated and Mel Maurer, Flex-O-Tube president, will continue as chief executive officer.

Alta Engineering Company has incorporated due to rapid growth. **W. E. Glissman** was named vice president.

W. E. Glissman
Alta Engineering Co.

Connecticut Filter Corporation, division of **Cuno Engineering Corporation,** Meriden, Connecticut, appointed **John E. McKay** regional manager of distributor sales. **George Whorf** was made manager of Cuno's new Cincinnati branch office at 2007 Madison Road. Also announced were two new sales representatives: **John R. Carlson Co.,** 4808 Broadway, Indianapolis; and **E. C. George Co.,** 2412 Far Hills Ave., Dayton, Ohio. Carlson Company will have the Indianapolis territory, and George Company will handle the Dayton, Columbus and Springfield, Ohio area.

Continued on page 124

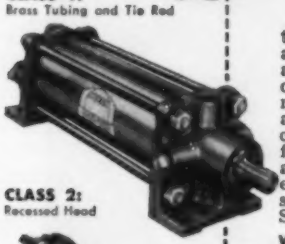
Hydraulic Unit Specialties Company, Waukesha, Wisconsin has recently expanded into this new, one floor addition which doubles their production capacity. The new wing also adds to office and development divisions. Greatly expanded engineering, laboratory and testing operations are being carried out.

Circle 39 on Reader Service Card

Do it with AIR POWER

Apply it with NOPAK Air Cylinders

CLASS 1:
Brass Tubing and Tie Rod



CLASS 2:
Recessed Head

CLASS M:
Mill Type Heavy Duty

There's a size and type of NOPAK Air Cylinder to meet practically every application need. They are available in 3 classes of construction, 6 standard mountings. Class 1 (standard brass tubing and tie-rod construction) is available from Shelf-Stock in standard sizes up to 8" in diameter with 15" maximum stroke. Write for latest Shelf-Stock Listings.

Write for Bulletin 101 which contains complete engineering data and dimensions on all 3 classes of NOPAK Air Cylinders.

There's a NOPAK representative near you. Look in the yellow pages of your Telephone Directory or write —

GALLAND-HENNING NOPAK DIVISION
2743 SOUTH 31st STREET • MILWAUKEE 46, WISCONSIN
Representatives in Principal Cities

NOPAK

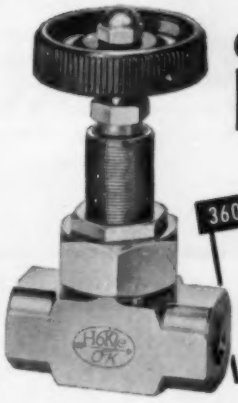
VALVES and CYLINDERS
for AIR and HYDRAULIC SERVICE

A 8809-1/9

Circle 48 on Reader Service Card

HOKE announces

10 valves in 1

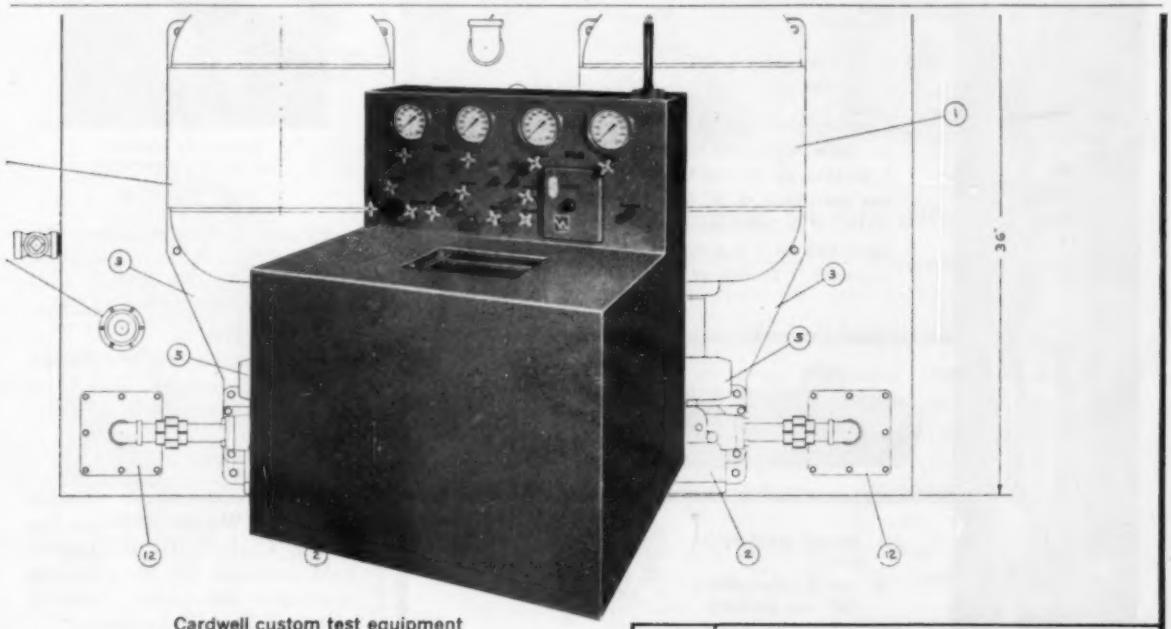


360 SERIES
High Pressure UNION BONNET GLOBE VALVE

For conditions ranging from 3000 psi to low vacuums, or distilled water to corrosive fluids. Series consists of four basic stainless steel bar stock valves... O-ring or Teflon packing with flat Teflon disc or vee point non-rotating, replaceable stem plug... plus six body styles. All parts interchangeable as well as replaceable. Choice of ¼", ⅜" or ½" pipe sizes or Swagelock tube fittings. Panel mounting, too. **Get the facts about this "10 in 1" valve. Write us today.**

HOKE

HOKE INCORPORATED
Fluid Control Specialists
187 S. Dean Street
Englewood, N.J.



Cardwell custom test equipment manufactured to meet your requirements for testing pneumatic or hydraulic devices.

The **CARDWELL MACHINE COMPANY**
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593
Several attractive territories still open for qualified Hydraulic representatives.

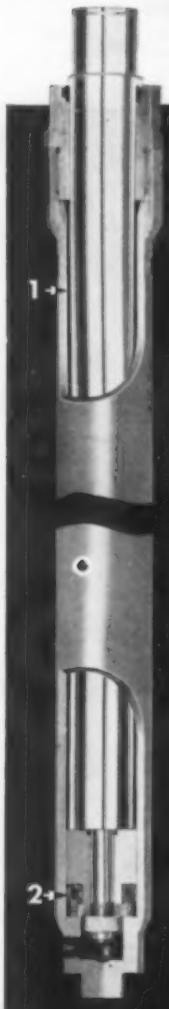
REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL CUSTOM TEST EQUIPMENT		
	DATE 9-21-56	DWN. BY H.L.W.	8269-2
	CHK. BY C.L.H.	SCALE 3/8"=1'0"	

Post Scripts of Industry
continued

Linear, Inc., Philadelphia, has purchased a new plant in Dallas, Pennsylvania. New equipment has been installed and some production facilities moved from the Philadelphia plant. Move should be completed early this year.

Control Equipment Company, Atlanta, Georgia, has opened an office in Birmingham, Alabama. **J. P. Cantor** was promoted to vice president and will be in charge of the new office with headquarters in Birmingham.

Good Design Deserves . . .
BHEW Custom-Built
HYDRAULIC CYLINDERS



BHEW custom-built hydraulic cylinders give dependable operational performance wherever they are used. These efficient, close-tolerance cylinders require minimum mounting space; their cost is reasonable; there is no charge for tooling. BHEW builds cylinders to meet your specifications, delivers them on schedule.

BHEW CYLINDER FEATURES:

Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

1. **Honed steel cylinder.**
2. **Full double-sealing "U" cup packing.**

Furnished in a wide variety of mountings and anchor brackets.

Our engineers will be happy to work with you on any cylinder problems you may have. Without charge, of course.

●

Send us specifications of your requirements, for full information.

BHEW BENTON HARBOR ENGINEERING WORKS, INC.
622 LANGLEY AVENUE ● ST. JOSEPH, MICHIGAN

Appointment of **A. Trail** as manager of the company's Rochester, N.Y. district sales office, is announced by **Vickers Incorporated,** Detroit. Assisting Trail as application engineer will be **Thomas J. Liddell.**

A. Trail
Vickers Incorporated

Thomas J. Liddell
Vickers Incorporated

Hannifin Corporation, Des Plaines, Illinois, has established two new distributors for their Crown line: **W. M. Steele Co., Inc.,** 171 Fremont Street, Worcester, Massachusetts; and **Meyer-Ekstrom Company,** 1975 North Cornell Avenue, Melrose Park, Illinois.

The Weatherhead Company's Fort Wayne Division has named **Carlisle Dean Hanson** field engineer for its industrial distributor sales staff. Territory will be Texas and Louisiana.

Parker Appliance Company, Cleveland, Ohio, appointed **Warner Company,** 3625 East 48th Avenue, Denver, Colorado, as distributor for the Colorado area.

Franklin C. Williams was promoted to sales coordinator and **A. H. Kelley** to manager, sales promotion and advertising by **The Falk Corporation,** Milwaukee, Wisconsin.

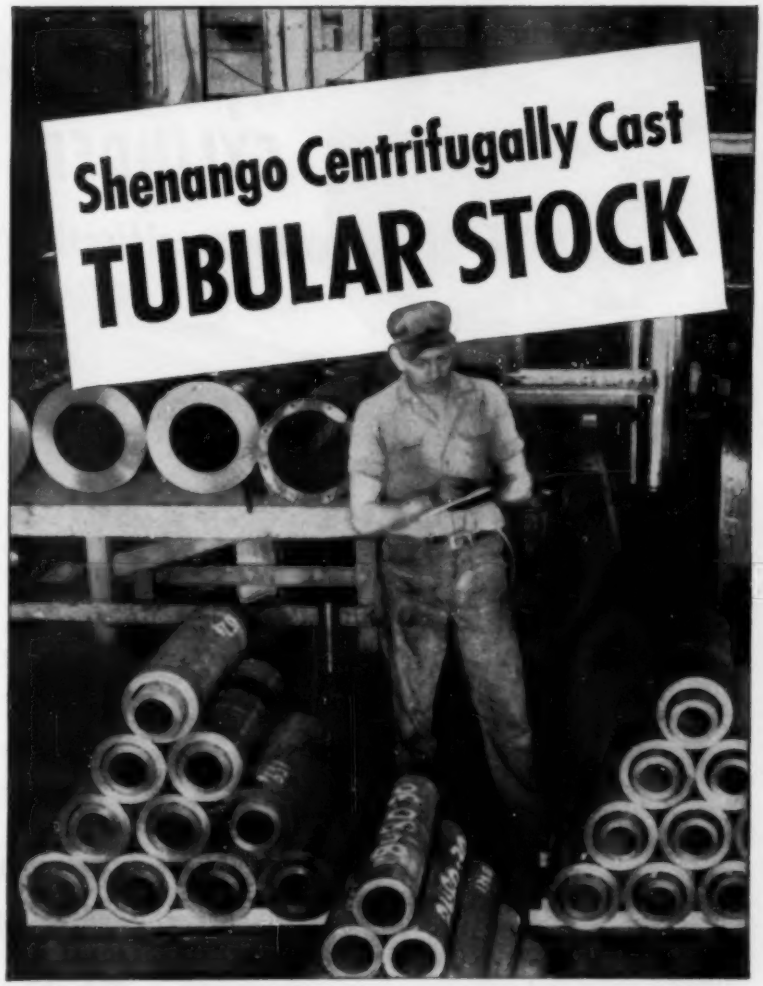
Dr. Robert E. Buchele was named staff assistant to the western division manager of **Servomechanisms, Inc.,** Hawthorne, California. Dr. Buchele was recently Associate Professor of Business Management, University of California, Los Angeles.

Bendix Systems Division, Ann Arbor, Michigan, is a new operating division of **Bendix Aviation Corporation.** The new division will concentrate on weapons systems requirements of the Department of Defense. **Dr. Russell D. O'Neal** was named general manager of the new division.

Bendix Aviation Corporation's Pacific Division has appointed **Kirke W. Marsh** as general project manager on a major guided missile project. **Eugene Planchak** was named Dayton, Ohio sales engineering representative for the division.

Kirke W. Marsh
Bendix Pacific Division
Bendix Aviation Corporation

The Graton and Knight Company, Worcester, Mass., held the first sales convention in the company's history in December. Walter W. Weismann, president, addressed his salesmen, who came from all parts of the country to attend the two-day session. ▼▼▼



...ideal for severe hydraulic service!

In standard tubular stock, as in special cylinders and other made-to-order components, the Shenango centrifugal casting process makes a world of difference. Centrifugal action forces impurities out of the molten metal, prevents inclusions and porosity, and assures a more uniform, *pressure-dense* grain! Thus the metal is stronger, more wear resistant, and machines to a superior finish.

Shenango tubular stock in both bronze and high strength Meehanite Metal is made in a complete range of I.D. and O.D. sizes and in lengths up to 20 feet, depending on diameter, to minimize cut-off waste.

For detailed bulletins or sales-engineering service write to Centrifugally Cast Products Division, The Shenango Furnace Company, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

Circle 8 on Reader Service Card

Hydraulic CYLINDERS

to specification

AT your service — since 1918 — the most modern machine tools to handle up to 15" I. D., including the last word in honing equipment and the most accurate of precision gauging equipment. Everything we do is to specification. Expanded facilities permit prompt delivery of 1 or 1000 pieces in any material desired.

Call Erie 2-3664 - Send specifications to

AMERICAN HOLLOW BORING COMPANY

1954 Raspberry St., Erie, Pa.

THE MARKET PLACE

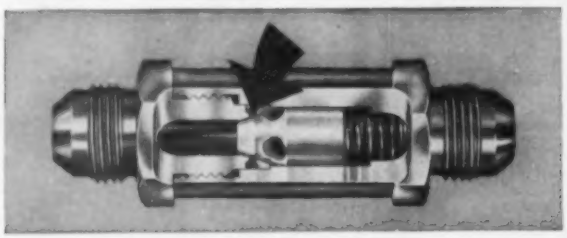
LAURELS MAKE A THORNY SEAT

Ross engineers are busy with tomorrow's air-control problem while collecting today's compliments. This forward thinking habit so often helps customers solve air power problems whose solutions looked years away that the demand for valving conceived for this approach grows daily. More designers who like to look ahead and have the experience and background to design the best air valves are needed to continue meeting this increased acceptance. If you can qualify to help ROSS push back air power frontiers, we invite you to discuss a position on our home office staff by contacting Ross Operating Valve Company, 120 E. Golden Gate, Detroit 3, Michigan. For field work, get in touch with the nearby Ross representative.

Classified Advertising Rates: Cost of Position Wanted Ad is $10.00 for the first inch, each additional line 90 cents. Cost of all other classified ads is $20.00 for the first inch and $15.00 for each additional inch or fraction thereof. Rates for Display Ads in this section will be sent on request.

Simple, Secure . . . Leak-Tight!

The FLEXIBLE SEAL SEAT*



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY

7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC

CHECK VALVES

* PATENT APPLIED FOR

REPUBLIC VALVES

INDUSTRIAL • CHEMICAL • AIRCRAFT

OFFSET GLOBE VALVE

NEEDLE AND GLOBE TYPES WITH J.I.C. AND AN STANDARD TUBE ENDS

High pressure needle and globe valves by Republic have forged bodies for super duty service—brass, steel, aluminum alloy, or stainless steel. Exclusive design features. Pipe, or AN or J.I.C. tube ends, or combinations, sizes ⅛" to 2". Operating range up to 5,000 psi, −65° to 350°F.

Manufacturers also of high quality low and hy-pressure check valves, relief, 2, 3, and 4-way plug valves, and special valves to specifications.

Write for complete new catalog No. 654A. Distributors in principal cities coast to coast.

191

RM REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

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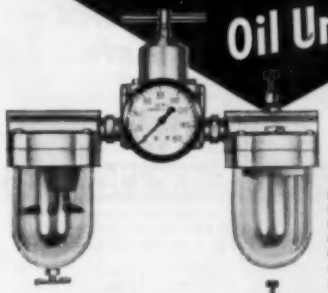
AIR-MITE
FILTER—REGULATOR
Oil Unit



- Instantaneous response to demand
- Special Filter for cleaner air
- Accurate injection of pre-atomized oil

The new AIR-MITE unit is designed and built for maximum operating efficiency, easy maintenance and long life Operates at pressures to 150 psi. Available in ¼", ⅜" and ½" T P. sizes. Individual units available separately.

Regulator—Incorporates piston cup instead of diaphragm. Provides more accurate, stable regulation, lasts longer. Direct reading gauge for close regulation of outlet pressure.

Lubricator — Automatically pre-atomizes and feeds oil mist into air stream. Simple micro adjustment permits accurate balance of oil-to-air supply.

Filter — Porous sintered bronze element filters better . . . won't collapse . . . is easy to clean. Built in air baffle. Brass drain cock.

Write for catalog sheets and prices.

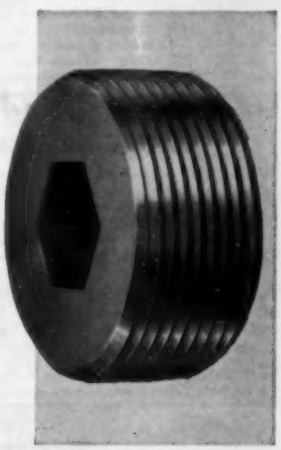
AIR-MITE Devices, Inc.

4401 W. KINZIE STREET • CHICAGO 24, ILLINOIS

specify standard

UNBRAKO

Dryseal-thread Pressure Plugs for hydraulic or fuel systems



Use them wherever liquids or gases must be contained under pressure—or in place of ordinary pipe plugs. UNBRAKOs seal without compound. They are made of the same high-strength alloy steel, have the same internal wrenching feature as UNBRAKO socket screws. Fully formed threads exceed NPTF specifications. Standard sizes—⅛ to 1¼ in.—are stocked by your authorized industrial distributor. See him for details. Or write Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.
SPS
JENKINTOWN PENNSYLVANIA

Circle 97 on Reader Service Card

Palley's SAVE YOU UP TO 85%

on HYDRAULIC CYLINDERS – VALVES – PUMPS – PARTS, etc. . .

OVER 10 YEARS EXPERIENCE in filling the needs of Aircraft and Heavy Industry led to the development of our own line of outstanding INDUSTRIAL HYDRAULIC CYLINDERS and supplies. We also carry one of the largest stocks of GENUINE GOV'T SURPLUS CYLINDERS, VALVES, PUMPS, MOTORS and Accessories. What we cannot supply we will CUSTOM MANUFACTURE to YOUR specifications.

NEW Palley HYDRAULIC CYLINDERS

All are Double Action with rugged steel construction throughout. Made to stand pressures up to 1500 PSI and 3000 PSI. Utilizes standard 'O' rings in all models and has leather back-up rings in the 3000 PSI types.

PART NO.	BORE	STROKE	SHAFT	P.S.I.	PRICE
P3-4-15E	3"	4"	1-1/8"	1500	$34.25
P-6-15E	3"	6"	1-1/8"	1500	36.75
P3-12-15E	3"	12"	1-1/8"	1500	44.75
P4-5-15E	4"	5"	1-1/8"	1500	39.50
P4-8-15E	4"	8"	1-1/8"	1500	45.75
P4-5-30E	4"	5"	1-1/2"	3000	55.25
P4-8-30E	4"	8"	1-1/2"	3000	61.50
P4-12-30E	4"	12"	1-1/2"	3000	69.75
P5-12-30-1	5"	12"	2"	3000	85.00
P5-24-30-1	5"	24"	2"	3000	115.00

SPECIAL GOV'T SURPLUS HYDRAULICS

40,000 LB. THRUST CYLINDER

A GOV'T SURPLUS BARGAIN! Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air cylinder. Has 4" bore, 18" stroke. 30½" long. Navy overhauled – LIKE NEW – **49.95**

VICKERS PISTON TYPE PUMPS

Made to top Aircraft specifications. RPM given below is recommended for constant speed.

PF9-713-20BCE – Delivers 5.3 GPM at 1000 PSI at 3000 RPM – USED $20.00

PF9-2713-10Z – Delivers 2.7 GPM at 1500 PSI at 3000 RPM – USED $22.50

VICKERS HYDRAULIC MOTOR

MF9-713-25BCF–Operates on 8.25 GPM at 1000 PSI at 3750 RPM–USED $22.50

2 GPM STRATO POWER PUMP

Positive displacement type. Capacity of 2 GPM at 1400 PSI. Displaces .450 cu. in. per revolution at 3750 RPM in either direction of rotation. Intermittent maximum RPM – 4500. Has a built-in, variable flow control valve in head. Piston type. 1 inch internal pipe ports. **New 27.50**

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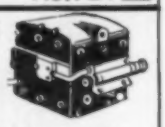

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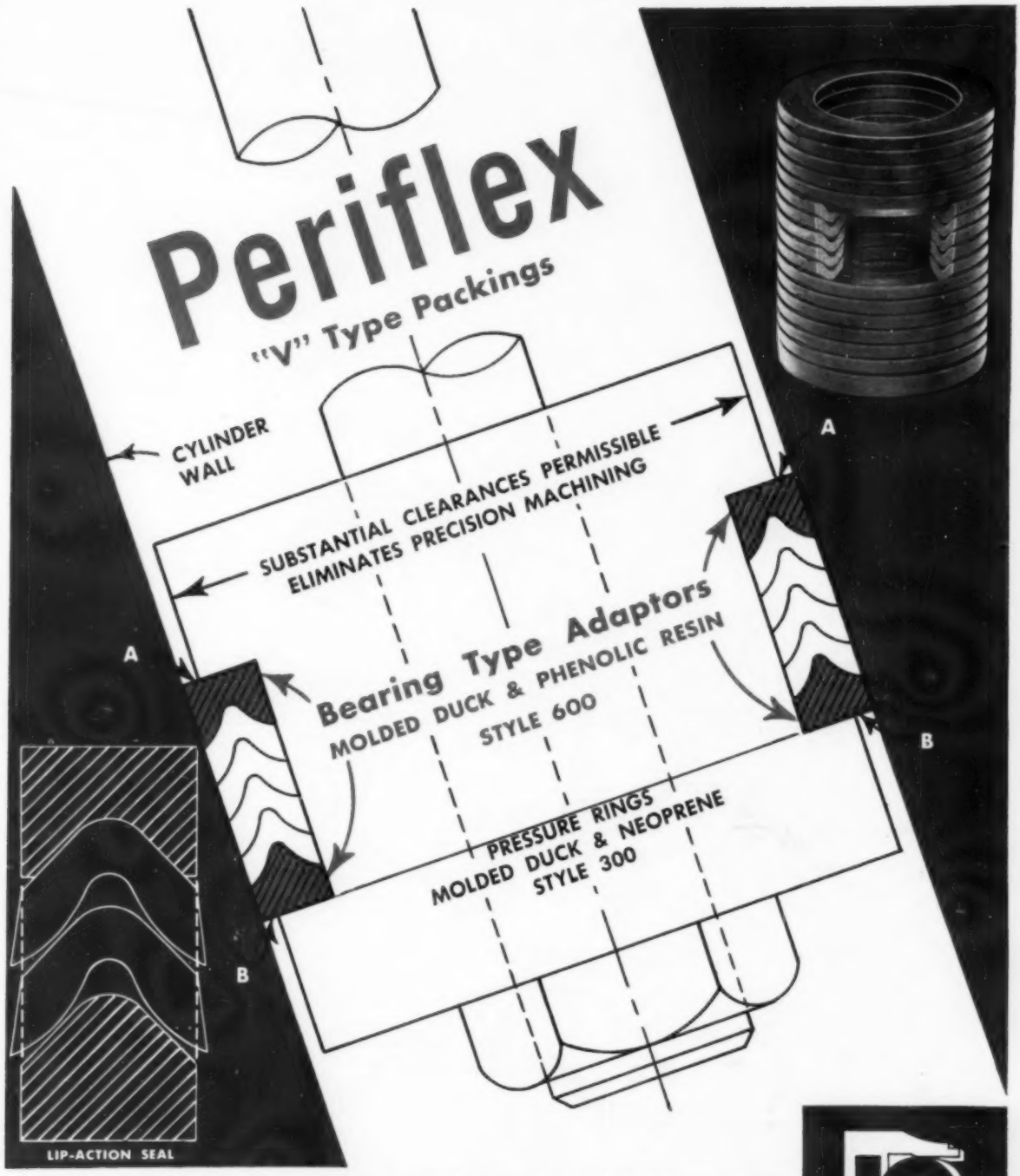

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